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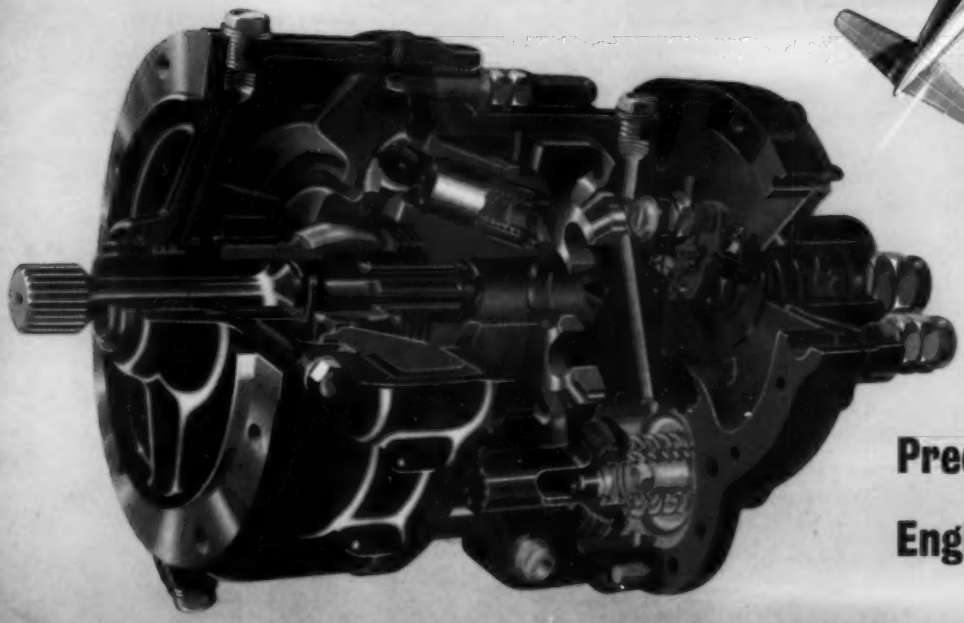

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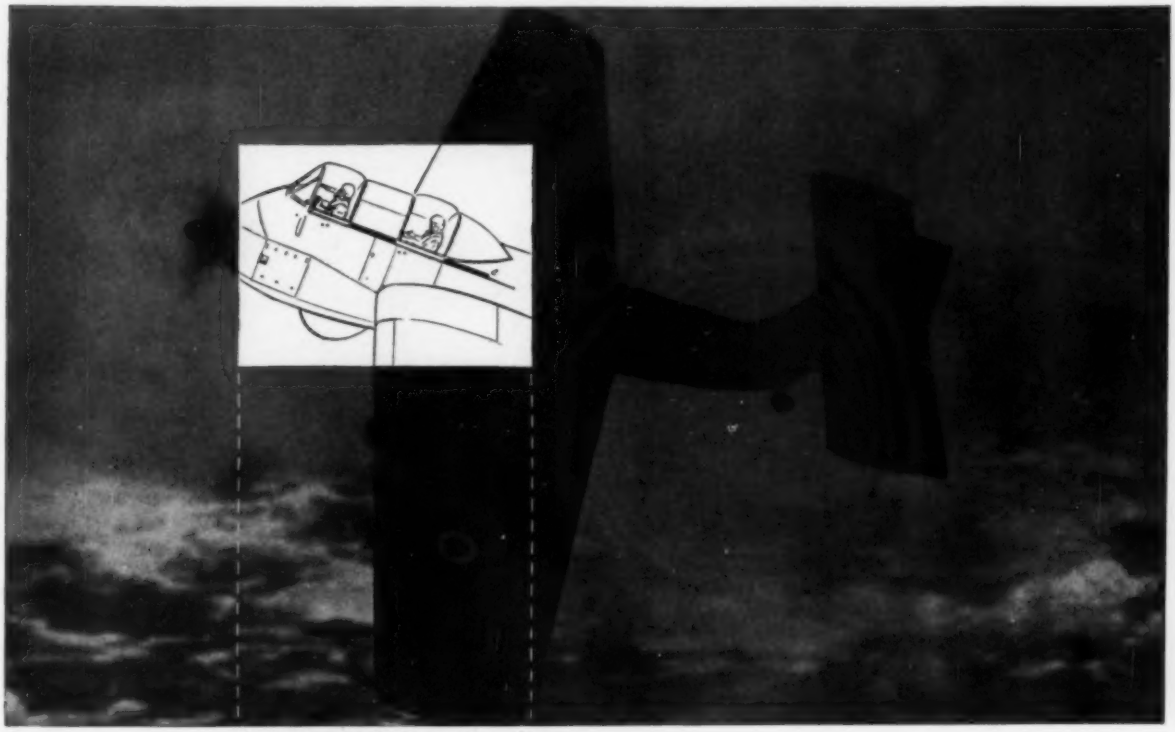
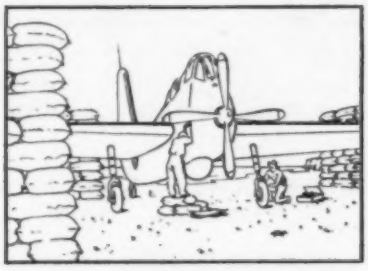
# Submarine weather—*Seamew* weather



*Simple to fly—even in adverse weather—the Seamew gives the pilot all-round visibility. Stalling and landing speeds are low. The fixed piston-action undercarriage absorbs the shocks of landing on a rough-and-ready airstrip.*



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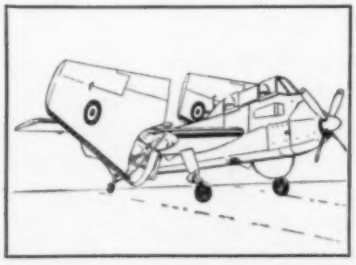

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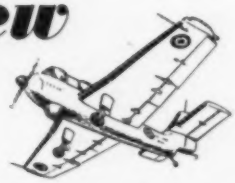

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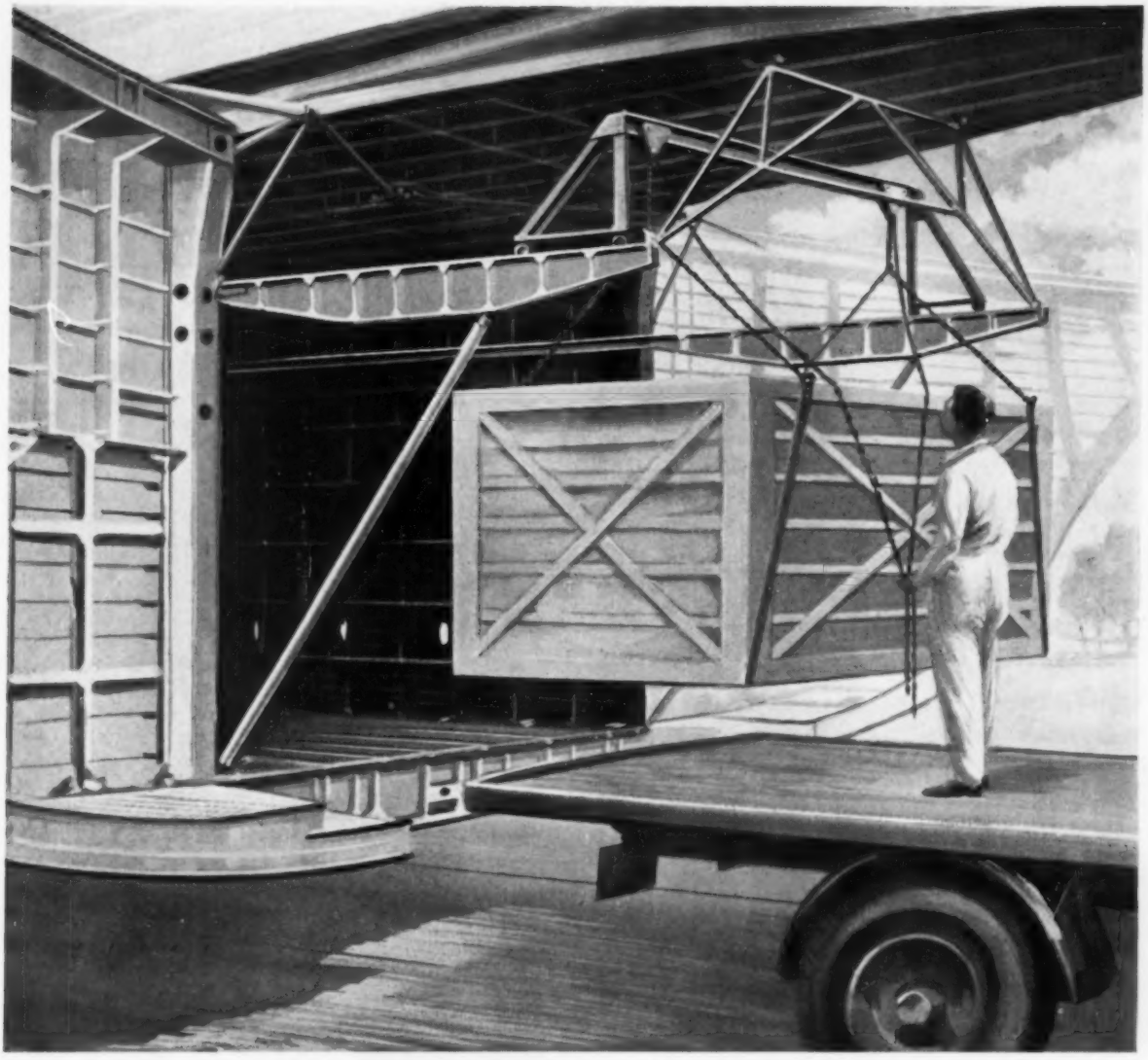

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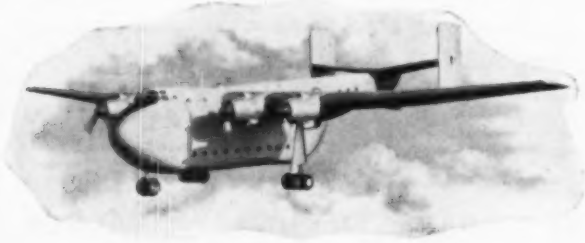

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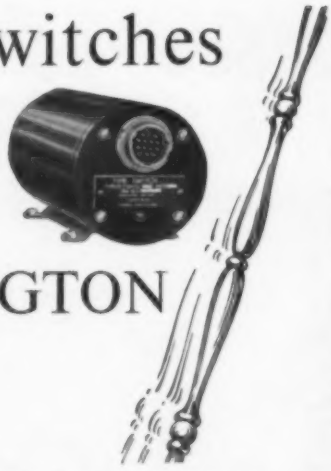
# Time Switches *by* TEDDINGTON



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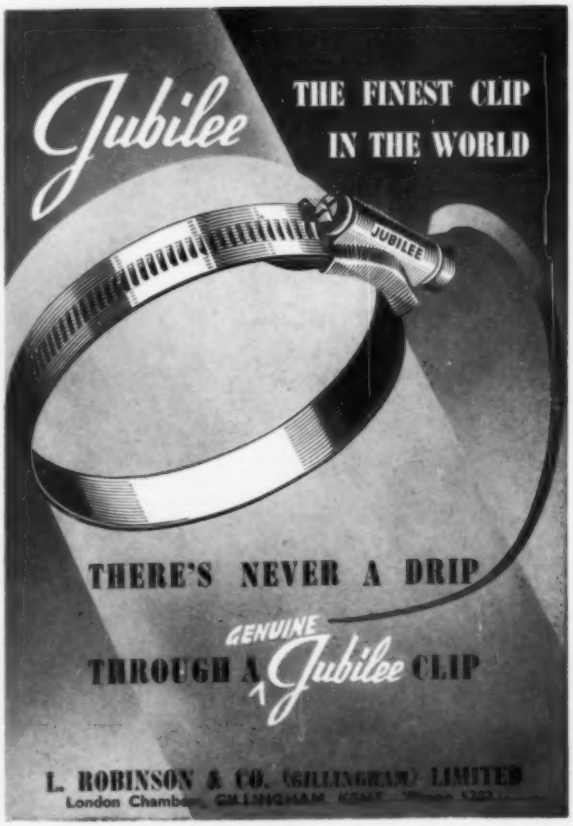

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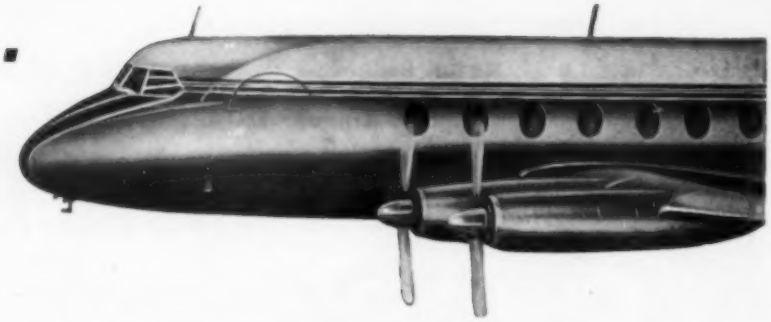

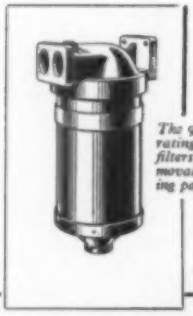

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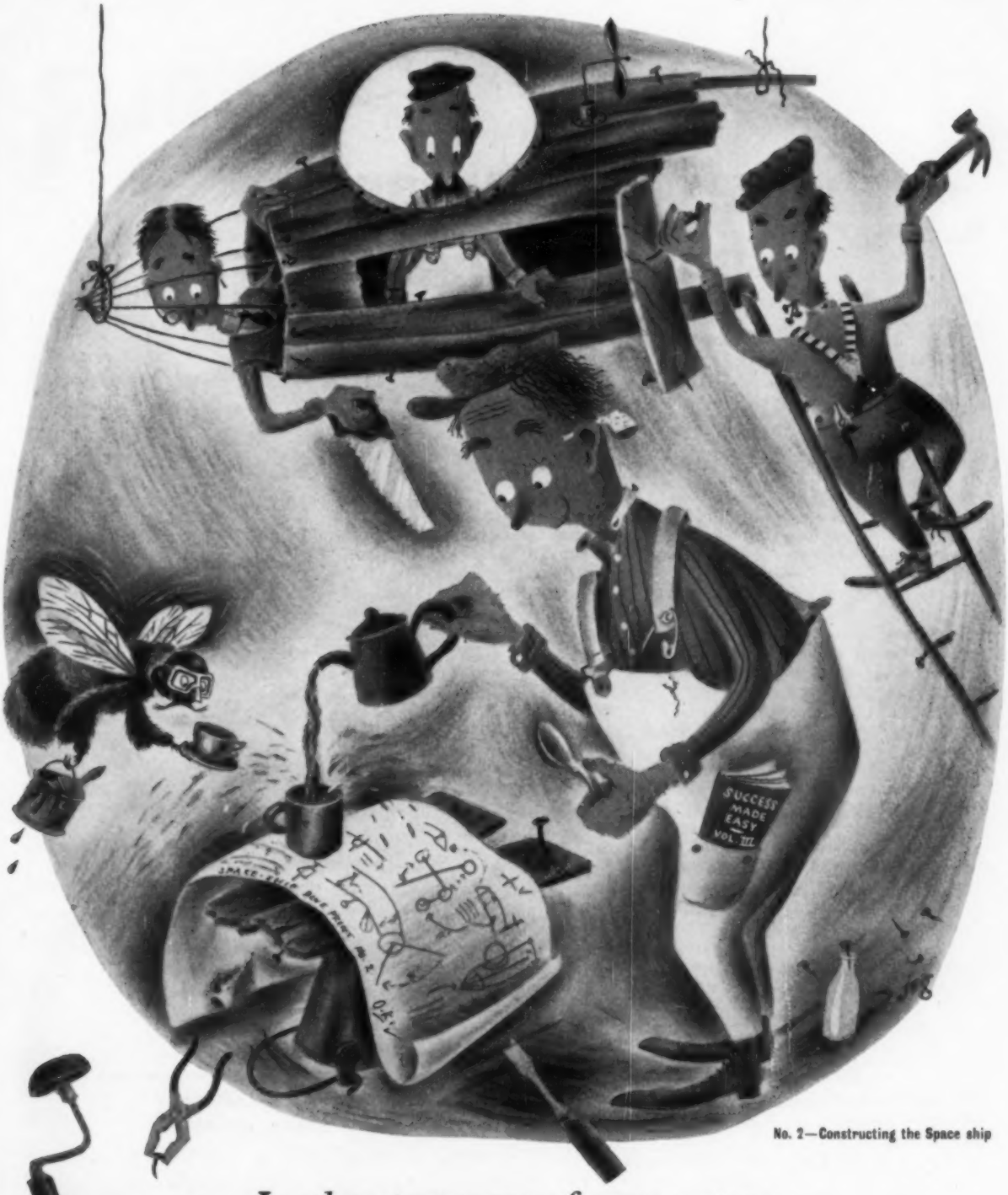


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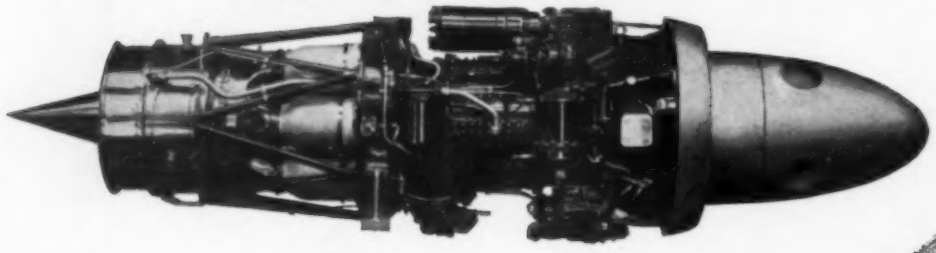

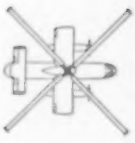

**ELAND** A Convair 340 aircraft converted to Eland engines will be on demonstration flights in Europe and the U.S. during this year. Another aircraft powered by *Elands* is the Elizabethan, converted for freighter evaluation. Napier *Elands*, fitted with auxiliary compressors for the tip-powered rotor system, will be mounted in Fairey's new large transport helicopter, the Rotodyne.

**ORYX** Two Napier *Oryx* engines are being mounted in the new Percival P74. Napier worked with Hunting Percival in the development of the *Oryx*, a 750-825 gas h.p. turbo-gas-generator which has been Type Tested at 750 g.h.p. This new Napier power unit eliminates all mechanical transmission.

**GAZELLE** The *Gazelle* is another Napier engine which is going places. Two *Gazelles* will be mounted vertically in the new Bristol twin rotor helicopter, whilst other designs to be powered by this engine are well advanced. The engines are directly connected to the rotor heads, providing mechanical transmission in its simplest form.

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FLIGHT
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AIRCRAFT ENGINEER

No 2456 Vol 69 FRIDAY 17 FEBRUARY 1956

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## Turboprop Tonmasters—

WE were heartened that our strictures on some aspects of British military air transport should have been commended to the House of Commons by Mr. George Wigg (especially so as he took the occasion to describe us as "respectable"); and though we might be presuming too far upon Mr. Wigg's indulgence to court yet greater favour in his eyes, we shall propound our views on a specific class of machine—the heavy turboprop freight or mixed-traffic transport—which must be of immediate concern to military and civil operators alike.

The present issue of *Flight* could hardly be more appropriate, for it describes, in the Douglas C-133, an aircraft of the class under consideration and one which represents a pitch of technical achievement to which no British maker has yet aspired, though characteristics accord with Commonwealth defence requirements.

In respect of capacity, performance and ease of cargo handling this newest Douglas is an altogether exceptional aircraft, and it must be regarded by Her Majesty's land and air forces as the shining realization (in another land, alas) of many a forlorn and fevered dream. It has a somewhat smaller but no less remarkable counterpart in the Lockheed C-130, and one much further advanced in production. Being of relatively long range and high performance, neither type is comparable with that most welcome newcomer to Transport Command, the Blackburn Beverley; nor (having no rear-loading and heavy-dropping facilities) will the R.A.F. version of the Bristol Britannia answer to the same formula.

So logical does the layout of the C-130 and C-133 appear, and such are the possibilities of civil developments thereby opened up, that earnest consideration must now be given to a British design for a fast, capacious, freight or mixed-traffic aircraft having cargo provisions to satisfy potential civil and military users.

It will be noted that the new American machines exploit to the utmost the great power, light weight and low drag of the turboprop; and, though this class of powerplant was pioneered by Great Britain, we still have no production-type unit of 6,000 h.p., as employed in the C-133.

Yet a third turboprop "tonmaster"—the Douglas C-132—is now on the stocks at Tulsa, and this is truly gargantuan in concept, calling for turboprops of no less than 15,000-17,000 h.p. each to lift its 250 ton weight. Such a demand could certainly not be met by any British engine known to be under development or even in contemplation, though the specified Pratt and Whitney T57 has been running on the bench for several months.

Clearly no British project could be on the scale of the C-132, but a machine of C-130 or C-133 calibre could be put in hand forthwith. A means of speeding its fruition might be the use of either the present Britannia wing or the wing now under development for the Bristol 187 airliner so prominent in the headlines last week.

## —and the Bristol 187

BEING a 130-passenger machine, the 187 should prove larger than the Britannia, and it will have four B.E.25 turboprops delivering, it may be supposed, a take-off output of the 6,000 h.p. order. If the forecast cruising speed of some 500 m.p.h. can be substantiated, the aerodynamic design must be of extreme cleanness, and the airscrews of very advanced form. In this latter regard there is no unanimity that the declared speed could be achieved, having regard to the formidable tractive problems involved; and for the type of long-range operation envisaged, the by-pass turbojet—represented by the Rolls-Royce Conway—is strongly preferred by some eminent authorities. It may be, indeed, that by-pass engines are in mind for the "large civil aircraft" now being designed by Handley Page and doubtless embodying boundary-layer control.

But whatever engines may come and go, the turboprop, as we have intimated, seems assured of a long and useful career in the great cargo liners and military transports of the coming years.

*A recent photograph of a pre-production D.H.110 all-weather naval intercepter, referred to in a news-item (opposite page).*

# FROM ALL QUARTERS

## Lord Trenchard

WE learn with deep regret, as we go to press, of the death of Marshal of the Royal Air Force Viscount Trenchard. He was 83 years of age, and had been suffering deteriorating health for the last two years. Often referred to in recent times as "the father of the Royal Air Force", Lord Trenchard learned to fly at the Sopwith school at Brooklands in 1912, took his certificate, and joined the Flying Corps, to become an instructor at the Central Flying School, Upavon, within two months.

We intend to publish a full appreciation in our next issue.

## Rolls-Royce Nuclear Project

IT has been known for some time past that Rolls-Royce, Ltd., have been studying the possibilities of nuclear energy for aircraft propulsion; this work has, in fact, been in progress for the past 18 months. Last week the company disclosed some details.

Nearing completion at Derby (in the grounds of a large private house) is a nuclear engineering laboratory, next to which is a department to accommodate a research and development team. This team, says the company, has been built up from the Aero Engine Division Advanced Planning Group associated with Dr. A. A. Griffith, F.R.S., and has been supplemented with specialists from outside, in particular Dr. S. G. Bauer and Mr. C. D. Boadle from Harwell.

The announcement states that the company are applying their engineering experience to the development of light-weight reactors which ultimately can be incorporated in engines suitable for air and surface transport. The statement adds: "The first experimental work on high-temperature liquid metals began last July in temporary test facilities . . . at Derby and already valuable results have been obtained".

The reference to liquid metals suggests that the technique being studied is that of conveying energy from the nuclear generator by means of molten metal (sodium is the most likely choice) passed through a closed circuit *via* a heat-exchanger, which transfers the heat to the propulsion unit, probably a turbine.

## In the House

ON February 7th, in the House of Commons, A.Cdre. Harvey (Macclesfield, C.) said that he no longer thought that the Air Ministry was the right department to order air equipment, because there were so many committees which had to be co-ordinated in order "to bring in all the technical information." Something had to be done to bring about a more flexible control in co-ordinating the requirements of the three Services.

The Minister of Supply, Mr. Reginald Maudling, agreed with A.Cdre. Harvey that our latest bombers should not be referred to as "medium bombers" because their height, speed and bomb load over the target area was as good as anything in the world. Mr. Maudling did not agree that there had been too much Treasury control in the past, but there was much to be said for the argument that when dealing with an aircraft an annual system of control had considerable disadvantages. The American system of what was called "fund financing" had many advantages.

There would be a substantial underspending in the current year, said Mr. Maudling, for several reasons. One was the cancellation of the major part of the Swift programme and another the replacing of the Javelin programme.

Concerning the system of Treasury accounting, Mr. Maudling said that the Air Ministry did not pay anything for an aircraft until it was finally delivered and complete and technical clearance had been given. So one often found, for instance, that an aircraft was 95 per cent complete, but that some piece still had to come from the manufacturers of the black boxes, or the magic boxes, to be put into the aircraft. Thus, 95 per cent of production expenditure did not appear in the Air Ministry's spending that year; so far as that was concerned, the spending appeared to be nil.

Mr. Maudling added: "Amid all the welter of exaggeration that always goes on when people discuss in the Press or elsewhere the aircraft industry, amid the welter of excessive blame or excessive praise, there are certain hard facts which we ought to get clear. I suggest the facts are these. First, in production, our aircraft industry does a first-rate job. If we have an aircraft technically developed and cleared, and we say to a firm, 'We want a hundred of these aeroplanes within a certain time,' the firm will take a price and a date and work to them efficiently. I do not think that we have any complaint on the production side. The difficulties always arise in the development phase, between the gleam in the designer's eye and the turning of the idea into a finished piece of hardware which can be put on the production line. That always absorbs time. My own impression, after visiting the United States, is that the development period in this country is not very different from what it is there.

## N.P.L. Director Appointed

THE new Director of the National Physical Laboratory is to be Professor G. B. B. M. Sutherland, Sc.D., F.R.S., who is at present a professor of physics, and director of the Biophysics Research Centre, at the University of Michigan. It is expected that he will take up his appointment next September.

*Prof. Sutherland.*

Prof. Sutherland succeeds Sir Edward Bullard, Sc.D., F.R.S., who retired on December 31st, 1955, and whose duties are at present being performed by Dr. R. L. Smith-Rose, C.B.E., D.Sc., M.I.E.E., as acting director. During the early part of the war, Prof. Sutherland was assistant to the Director of Aeronautical Research at the Ministry of Supply. In 1941 he was made head of a Cambridge group carrying out research for M.o.S., M.A.P., and the Admiralty; this work, on the structure of hydrocarbons, was concerned with the development of improved aviation fuels. In 1947 Prof. Sutherland became Reader in Spectroscopy at Cambridge and in 1949 went to America to take up his post at the University of Michigan. Prof. Sutherland was educated at Morgan Academy, Dundee, and St. Andrew's University. From 1935-49 he was a Fellow and Lecturer at Pembroke College, Cambridge.

**"FLIGHT"**

**As the continuance of the dispute in the printing trade necessitates amendments to printing schedules, this issue is reduced in size and copies may be late in reaching readers. To all who are inconvenienced in any way we offer our sincere regrets in circumstances beyond our control.**

## A. V-M. A. C. H. Sharp

WE record with regret the death of A. V-M. A. C. H. Sharp, C.B.E., D.S.O., A.F.C., director of export sales for the Glenn Martin Aircraft Company. He died in Baltimore on February 7th, after a heart attack, at the age of 51. Educated at King's College School, Wimbledon, and Selwyn College, Cambridge, "Bobby" Sharp entered the R.A.F. in 1924, serving with Nos. 4 and 26 Army Co-operation Squadrons and No. 23 Fighter Sqn., and as an armaments specialist in India. After graduating from the Staff College in 1937 he joined Bomber Command planning staff and later commanded No. 18 Sqn. In 1941-42 he was Deputy Director of Organization, Air Ministry, and was then seconded to the American 8th Air Force as Deputy Chief of Staff. He held this post until early in 1944, when he went to South-East Asia Command as A.O.C. Admin., Base Air Forces. In the following spring he was appointed to a similar post with "Tiger" force, then being formed for heavy bomber action against the Japanese. After the war he returned to the Air Ministry, this time as Director of Accident Prevention; he graduated from the Imperial Defence College in 1948; and before his retirement—in 1953, at his own request—he was Director-General of Organization, Air Ministry.

## U.S.-British Appointment

AN American having an unusually long and close association with British aviation has joined the aeronautical products division of Honeywell-Brown, Ltd., of Perivale, Middlesex (who are British associates of the well-known Minneapolis-Honeywell Regulator Company). He is Mr. Eric Thompson Bradley, who has been Defence Production Officer at the American Embassy in London since 1950. He is particularly well known in the British industry in connection with the M.D.A.P. programme and offshore procurement. Mr. Bradley's connections in this country were, however, formed very much earlier—in 1914, when he came to England and enlisted in the Royal Engineers. In 1915 he was commissioned in the R.N.A.S., in which, as a pilot and flight commander, he served with distinction until 1918, when he was recalled to join the U.S. Air Service. In the Second World War he was at first attached to the British Purchasing Commission in New York, but early in 1942 was back in uniform as a U.S. Air Force colonel—and also back in London, where he worked in close collaboration with M.A.P. He was appointed O.B.E. in 1945. After the war he was appointed Director of the Aviation Division of the U.S. Foreign Liquidation Commission for the Pacific and China areas.

*Mr. Bradley.*

## Fighters from Christchurch

DURING the latter part of 1951 the Airspeed Company was finally integrated within the de Havilland Enterprise and the company's organization at Christchurch, Hants, was expanded and fitted for design, pre-production and development on the Vampire and Venom. Under Mr. W. A. Tamblin, F.R.Ae.S., A.M.I.N.A., who was appointed chief designer, the Christchurch team have since produced the modern Vampire advanced-flying and weapons trainer, the Venom N.F.3 night fighter and F.B.4 fighter/bomber and the carrier-based Sea Venom 21 and 22 all-weather fighters.

All these aircraft are in extensive service and have been bought by many overseas air forces and navies. The latest Venoms represent an incomparable advance in fighting efficiency over the earlier marks, embodying powered ailerons, a most comprehensive search and interception radar installation and many other refinements. A heavy load of new project and experimental work has also been undertaken at Christchurch, of which a particularly notable programme has involved flying a Sea Venom with blown flaps. The boundary layer is controlled by air bled from the Ghost engine and expelled at high velocity over the flaps; preliminary trials show promise of important advances.

By far the most important task facing the organization is the development of the D.H.110 all-weather naval intercepter powered by two advanced Rolls-Royce Avons. The accompanying photograph shows a recent Christchurch-built 110, incorporating many advances over earlier prototypes. Pylons under the wings are doubtless associated with guided-weapon armament, which is supplemented by a pack of four 30mm guns. The air brakes, under the forward fuselage and jet pipes, are clearly seen, as is the experimental calibration nose-probe.

## Forty Years On

ORIGINALLY formed in 1916, and recently revived, the Sopwith Apprentices Association held their first annual reunion dinner on Thursday of last week, the London Airport North restaurant being happily chosen as the venue.

The occasion was of a strongly characteristic nature, for all the members of the Association are men (now mainly in their fifties) who have gone far in their chosen professions. Some are in senior posts in industry; others have attained high rank in the R.A.F.; some are now in the top management of Hawker Aircraft—which, as everyone knows, grew from the Sopwith Aviation Company at the end of World War I. But, however varied their endeavours during the 35-40 years that have elapsed, none of them seemed to have forgotten the experiences and friendships of the Kingston-on-Thames skating rink in which the first Sopwith aircraft of the Kaiser's war were built. Reminiscences of 1½-strutters, Pups, Camels, Triplanes, Salamanders and Snipes—and of the men who made and flew them—were fond and numerous.

A list of the majority of those present, most of whom were Sopwith apprentices, is, we feel, worthy of quotation:—

A.-V.M. L. T. Pankhurst, Director-General of Personnel, Air Ministry; A. Cdre. C. B. Wincott, manager, guided weapons division, Fairey Aviation; W/C. W. W. Warner, chief engineer, Airwork, Ltd.; Mr. R. W. Sutton, aircraft consultant, a former Hawker director; Mr. Frank Buckell, manager of the G.E.C. aeronautical department; Mr. Donald Healey, the car manufacturer; Mr. J. D. Stranks, Hawker works director; Mr. J. H. Williams, equipment engineer (road services), London Transport; Mr. L. A. Pollard, formerly works manager at Hawkers' Langley factory; Mr. Herbert Parsons, general sales manager, Pirelli, Ltd.; and Mr. V. W. Derrington, motor equipment designer and manufacturer, who is hon. secretary of the Apprentices' Association and who organized the reunion. A.V-M. Pankhurst was in the chair; Mr. Neville Spriggs (Hawker Aircraft managing director) and Mr. G. Anderson (export sales and publicity manager) acted as hosts; S/L. "Joe" Taylor, Shell aviation sales manager, was present to represent the Avro 504 Club; and there was one youthful guest—R. C. Cannon, the Hawker apprentice who won last year's shield given by the Association.

***MARSUPIAL MOMENT:** A particularly revealing view of the loading operation of a Republic RF-84F on to a Convair RB-36. The scene was photographed at Fairchild A.F.B., Washington.*

# THE CAPABLE CANBERRA

## *Versatile Developments of a Sound Basic Design*

POSTERITY will remember the Canberra for diverse reasons. The Royal Air Force as a whole will remember it as the first completely new high-performance aircraft to reach squadrons since World War 2; the U.S.A.F. have found it "a pilot's airplane," easy to fly and maintain and extraordinary in that it is not of American design; to British engine builders the Canberra has been literally invaluable as the vehicle for developing all our first generation of axial turbojets (and other engines besides); and the Canberra has also performed sterling service in many kinds of development programmes, involving those of guided weapons, flight refuelling, electronics and straightforward aerodynamics.

The original design was prepared by an embryo English Electric team which had been formed at the M.A.P's invitation. The first type was the B.1 which, since it had no visual bomb-sight, was clearly designed for blind bombing. The prototype, VN 799, flew for the first time on "Friday the 13th" of May 1949. It was equipped with two of the then-new Rolls-Royce Avons and, as a safeguard against possible development troubles, the second machine was powered by Rolls-Royce Nenes. This aircraft, and all subsequent Canberras, carried drop tanks at the wing tips.

For reasons which seem fairly obvious it was decided to develop a visual-bombing Canberra, and this soon emerged as the B.2. The original radar nose was eliminated, the fuselage framing was extended forward, and a transparent nose was substituted, incorporating an optically flat panel, offset to enable the bomb-aimer to crawl around the pilot's feet. Production of the B.2 was, by British standards, very substantial. It measures up to its specified task and is well liked by its crews.

In order to speed production, three daughter firms—Short and Harland, Avro and Handley Page—were asked to undertake Canberra manufacture, and all began deliveries during 1952.

Before the design was fully "productionized" it was ordered for the Royal Australian Air Force. A special production feature is the extensive use of mould lofting. Almost every airframe component is fully developed and laid out on loft plates, of which there are roughly 600 to each mark of Canberra. As the Australian machine, designated B.20, differed in several respects, the Government Aircraft Factory in Melbourne was supplied with sheets printed in non-reproducing ink, upon which the Australian staff could ink in portions common to both aircraft and make their own modifications. All the Canberra daughter-firms in this country were supplied with loft plates, some even conducting their own lofting. This technique materially assisted production.

The next production aircraft was the P.R.3, which was specially designed for long-range photo-reconnaissance duties. The fuselage was lengthened by inserting an extra bay for cameras, and other modifications included reduction in the number of crew to two and deletion of the flat bombing-panel. This version was manufactured only by English Electric.

At about the same time appeared the T.4. Introduction of the Canberra to Bomber Command left no doubt that there was a need for more pilot training, especially dual instruction, and the T.4 has side-by-side dual controls with provision for a navigator in the rear. It was developed solely as a trainer and is employed at Bomber Command operational conversion units. Each Canberra and Valiant station also has one or more for normal checks, particularly on the limited panel.

As the Canberra developed so did the Avon powerplant, and the airframe was obviously capable of taking advantage of the increased thrust of the later engines. The latter, which are distinguished by the long bullet fairing housing a triple-breech starter, were first fitted to the Canberra B.5. This was a conversion of one of the original prototypes and, although it had a visual-bombing panel, had an otherwise "solid" nose and seems to have been intended for blind bombing. Increased tankage was also incorporated in this aircraft and in all subsequent marks.

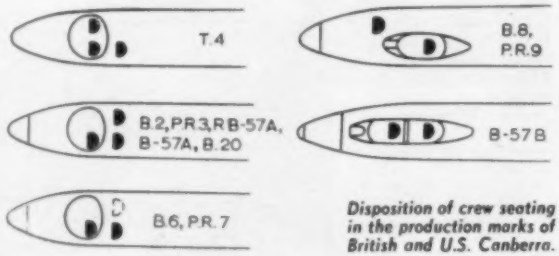
All the experience previously gained was built into the next version, the Canberra B.6. This machine, which is only now beginning to pass out of production at the parent firm, incorporated the improved Avon and increased tankage and had a better performance than the B.2. It equipped new squadrons in Bomber Command (for the B.2 remains in service) and B.6s are also being converted for strike and attack operations with tactical air forces. This mark has also been built in numbers by Short and Harland. A closely related machine is the P.R.7, which bears the same relationship to the P.R.3 as does the B.6 to the B.2. It is in large-scale service with Bomber Command.

*This Canberra B(I).8 was photographed during a recent test flight—*

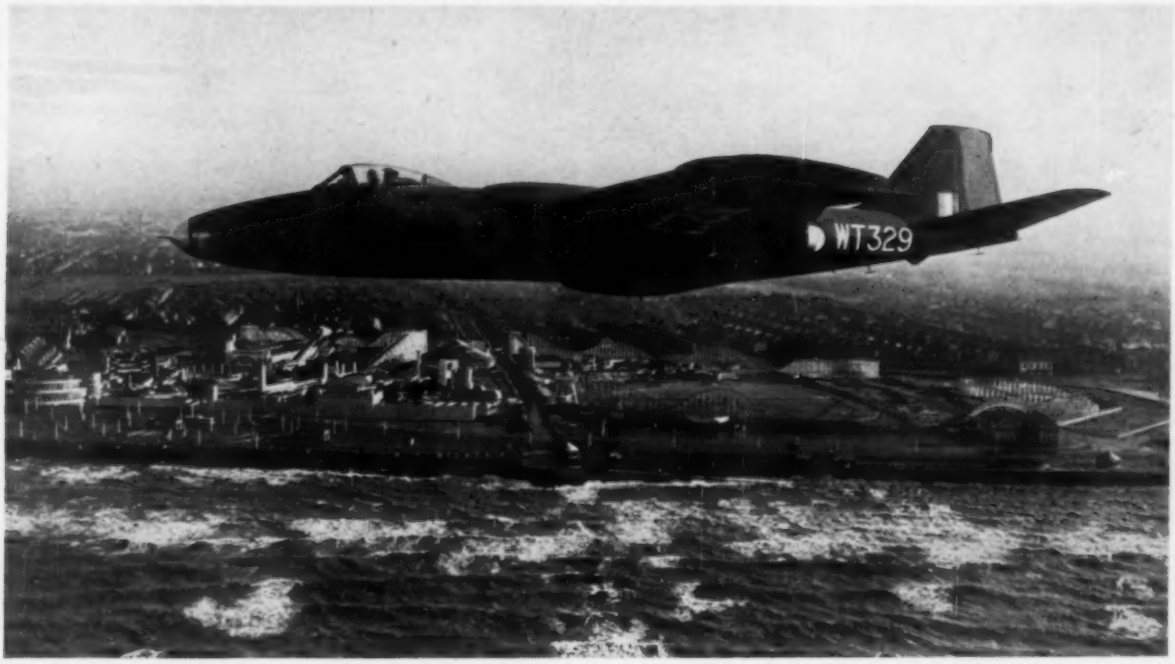
For many years English Electric nourished the concept of an interdictor Canberra, and this project eventually came to fruition to meet an R.A.F. requirement which resulted in the Canberra B(I).8. A wholly new front fuselage is fitted for visual bombing with a crew of two, the navigator being seated ahead of the pilot, who is accommodated in a fighter-type canopy offset to port. Various weapons can be carried internally and on large pylons under the wings. Four 20 mm guns are also fitted, these being removable as a complete package from the rear weapons-bay. The forward bomb-doors are specially stiffened against gun blast. It is believed that this installation provides more rounds-per-gun than that on any other fixed-gun aircraft. This Canberra epitomized the inherent versatility of the aircraft, fulfilling its rôle as an all-round replacement for the Mosquito. The first B.8 was the old VX 185 (which had been the lone B.5) and it was converted at Preston in the summer of 1954.

At this point reference should also be made to various Canberras which have been equipped with advanced forms of A.I. radar, presumably for research or system development. One of these was converted by Boulton Paul, Ltd., to carry an installation which seems superficially similar to that of the Javelin.

As the great value of a Canberra interdictor became better appreciated, the introduction of aircraft with this capability was hastened by converting B.6s on the production line to carry the gun pack and wing pylons. These aircraft are designated B(I).6 and are preceding the true B(I).8s into service with the 2nd T.A.F. in Germany. Another large-scale conversion job is that of turning ex-operational B.2s into T.4s.




*Disposition of crew seating in the production marks of British and U.S. Canberra.*




*—from the English Electric Company's airfield at Warton in the Fylde Peninsula. In the picture above can be seen Blackpool's amusement park.*

Latest of the Canberras which can be mentioned is the P.R.9. Aerodynamic modifications have been incorporated in this mark, the increased span and reduced thickness/chord ratio improving the all-round performance, particularly in the ceiling and buffet boundary. It seems, in fact, quite obvious that the Canberra 9 has the highest all-round performance of any British Canberra, particularly as the Avons are without doubt of a new mark, of much-increased thrust. A standard P.R. fuselage is employed, with a front section similar to that of the B(I).8.

This summary of British Canberra progress may fittingly be rounded off with reference to the numerous special-purpose machines which are so notably pulling their weight in all parts of the country. For engine development the Canberra combines the assets of a proven airframe, extreme altitude performance, ease of fitting different types of powerplant and adequate capacity for recording gear and instrumentation. Canberras are also under development, or in service, as tankers and target tugs and, although no details may be given, are also engaged in the development of modern weapons systems.

Canberras have been, or are being, exported to Venezuela, Ecuador and Peru and a few B.6s are engaged upon various programmes in France. In Australia the B.20 is now well established in R.A.A.F. service and it is apparent that the Government Aircraft Factory has done an exceptionally fine job in this connection.

Clear indication of the unique merits of the Canberra was provided by the 1950 decision of the U.S.A.F. to place an Americanized version of the design in production with the Glenn L. Martin Company at Baltimore. Assisted by numerous sub-contractors, and employing J65 Sapphire engines made by both Wright and Buick, Martin did a first-class conversion job and rapidly laid down production at a rate which, had the Korean war continued, would by now have resulted in many thousands of aircraft. The formidable task of setting up production of the Martin B-57 (as it was designated) in Plant 2 at Baltimore was greatly assisted by the British lofting technique. This astounded the Martin engineers, who photographed every plate and were delighted at the results. The value of the system was brought out when it was found that sub-contracted ailerons for the B-57s were unacceptable for flight. English Electric immediately shipped Canberra ailerons from Preston and it was found that they perfectly fitted the first B-57—which, in fact, first flew with British ailerons.

The first American Canberra was the B-57A, which externally resembled the British B.2; most of these aircraft were RB-57A reconnaissance machines. The major production version has been the redesigned B-57B, in which pilot and navigator are seated in tandem under a very large clam-shell canopy. The B-57s embody a rotating bomb-door upon which are mounted all the internal stores (*Flight*, August 14th, 1953)—a wholly Martin development which notably improves the fighting efficiency of the design. Rocket projectiles and napalm tanks can be carried under the wings, the structure of the latter being completely revised to accommodate eight 0.5in guns—an arrangement which probably reduces internal tankage. Large numbers of B-57Bs are in service in the U.S.A., Japan, Germany and elsewhere, and are proving very popular with air- and ground-crews. Among the multitude of tasks which they have tackled has been the sampling of atomic clouds.

Later U.S.A.F. Canberras include the B-57C trainer, the B-57D, a redesigned high-altitude aircraft with increased wing span and much larger Pratt and Whitney J57 engines, and the B-57E tug. Martin also prepared a design study for a transport version which has not been built. The company is, of course, in the fortunate position of being able to supply aircraft more-or-less tailored to one particular rôle; nevertheless, the machines now being built at Preston are the equal of contemporary machines in any air force.

*Last October two Martin RB-57Bs called at the Canberra's ancestral Lancashire home on their way to join a unit of the U.S. 12th Air Force at Laon in France. One of the tandem-seat Americans is pictured here at Warton in company with a Preston-built Canberra B(I).8. The two make a most instructive comparison.*

# HERE AND THERE

### Egyptian Ilyushins

REPORTS from Egypt say that in addition to Mig fighters the Egyptian Air Force has Russian jet bombers; a number of Ilyushin Il-28 light bombers have been seen. It is believed that they were flown in *via* Syria.

### Temco Jet Trainers

THE Temco Aircraft Corporation, of Dallas, Texas, is designing and building a small two-seater *ab initio* jet trainer designated Model 51. It will be offered for civilian and military pilot-training in the U.S.A. and overseas.

### One-Dollar Airport

IT is reported from Paramaribo that Pan-American World Airways are willing to sell Zanderij Airport to the Surinam Government for the price of one dollar, conditional upon their exemption from landing fees for a period of 20 years. The offer follows a recent Government decision, taken on the advice of an American expert, that it will be considerably less costly to improve the present airfield than to build a new one.

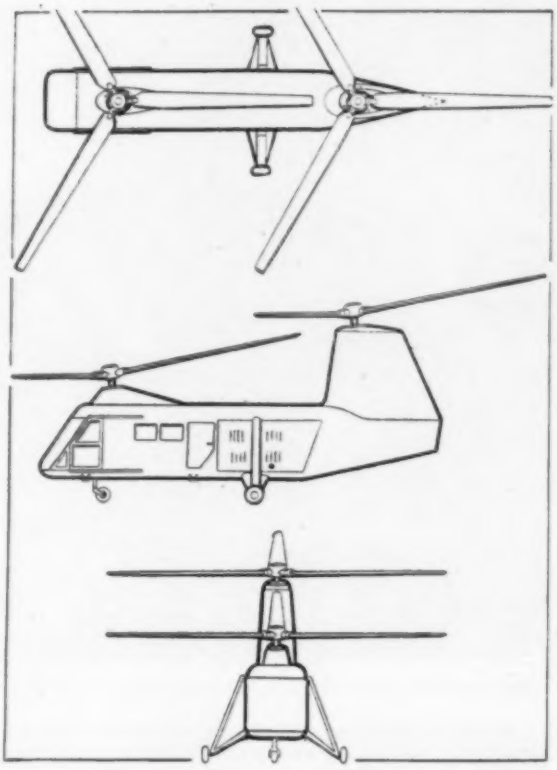
### Verticality

THE Board of Piasecki Helicopter Corporation are putting to shareholders a resolution that the company's name be changed to Vertol Aircraft Corporation. The new name is intended to "emphasize the development and production of aircraft with vertical take-off and landing characteristics."

### Prizes for Treatises

THE Royal Society of Arts is again offering the Howard Prize of £50 for a treatise on mechanical motive power, and the Fothergill Prize of £20 for a descriptive essay or model embodying a new idea for the prevention or suppression of fire. Details are obtainable from the Royal Society of Arts at 6/8 John Adam Street, London, W.C.2.

*IN THE FASHION: Seen in this drawing to be of advanced design, the Molyneux XM-1000 will be Australia's first helicopter (apart from a single-seat prototype model due to fly shortly). A five-seater, it will have a Pratt and Whitney Wasp engine, will weigh 4,000 lb all-up, and have a range of 350 miles.*



### Big Reunion

PLANS are already in hand for the third R.F.C. and R.N.A.S. Reunion, to be held on August 31st next at the Hyde Park Hotel, London. Details and tickets will be available shortly. The first big reunion was held in 1947 at Londonderry House and the second in 1952 at the Dorchester, London.

### The Pentland Firth Rescue

THE Admiralty has received a message of gratitude from the Norwegian owners of the 9,862-ton freighter *Dovrefjell*, whose crew of 41 were taken off by helicopters when the vessel went ashore on the Pentland Skerries on February 3rd. The aircraft—two from R.N. Air Station Lossiemouth and one from R.A.F. Station Leuchars—made a series of flights between the stranded vessel and a field near John o' Groats. High seas made it impossible for lifeboats to go alongside, but the helicopters were able to winch up the men in spite of the fact that spray was rising 100ft high.

*TAIL-FIRST COMET: This Comet fuselage was recently moved by Field Aircraft Services, Ltd., from Farnborough to Cardiff. It is G-ALYU, which was tested in the R.A.E. tank, and which is now being used by the M.T.C.A. at Cardiff for passenger escape tests.*

### For Speeding-up Production

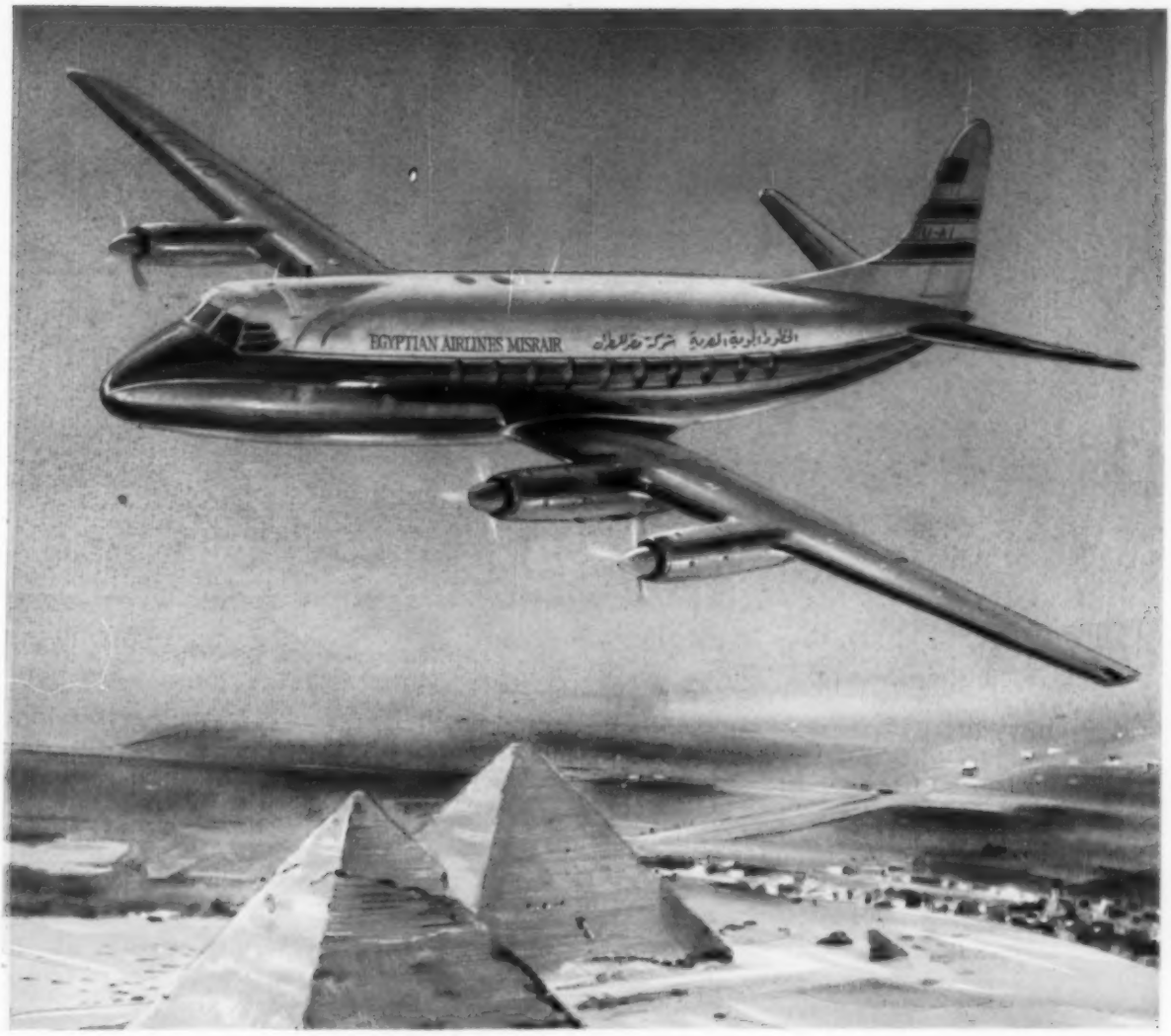
OVER 250 exhibitors will be participating in the fifth Mechanical Handling Exhibition, to be held at Earls Court, London, from May 9th-19th. The organizers are *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

### Any More for the A2D?

TWO potent war machines have come off second best this week, one apparently at the hands of a printer, the other in process of French/English translation. In Bill Bridgeman's new book, *The Lonely Sky*, the Douglas A2D Skyshark carrier-borne attack bomber is captioned as the Skylark, and in a catalogue of French aircraft the Marcel Dassault Mystère IVB is confidently described as a "dreadfull ground attacker."

### World Model Championships

FOLLOWING the British success in Germany last year, the Society of Model Aeronautical Engineers is organizing this year's world championships for power-driven models. Organization is likely to cost something like £1,000, and the Society (whose headquarters are at Londonderry House, Park Lane, London) is inviting contributions from all who are interested in the development of aeromodelling. The contests are to be held at Cranfield over the August Bank Holiday weekend.

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# OPERATION AFRICAN TOUR

## *How No. 9 Squadron's Canberras Honoured the Queen in Nigeria*

**THE account on this page is based on notes provided by an Air Ministry officer who flew out to Nigeria with No. 9 Squadron's Canberras and accompanied them during their tour. In our issue of February 3rd we published a series of air-to-air photographs of the machines and a portrait-group of the crew.**

The six Canberras for the fly-pasts and demonstrations, plus the reserve Canberra, landed at Ikeja Airport, some 15 miles from Lagos, at 1600 hr (local time) on Thursday, January 26. They came in singly, first S/L. L. G. Bastard, No. 9 Squadron C.O., flying the A.O.C.-in-C., Bomber Command, Air Marshal Sir Harry Broadhurst, and then the Force Commander, A. V-M. J. R. Whitley. An earlier plan for the bombers to fly over the city before landing had to be abandoned, for the local authorities feared that the first appearance and sound of jets of any sort over this teeming city and surrounding villages and townships might have unfortunate repercussions upon the nerves of the uninitiated population. So the arrival was a very gentlemanly affair. The 2,000 miles across the Sahara from Idris had taken 4¼ hr, and the previous day's flight from the snows of Binbrook to the rain of Idris 3¼ hr.

All aircrew and passengers were in excellent fettle, but they found the 90 deg of heat and a large but unspecified amount of humidity something of a shock. Iced squashes from the four refrigerators in the squadron tents on the airfield were welcomed. The C-in-C. and the Force Commander recorded for B.B.C. *Radio Newsreel* (Lionel Fleming) and for the Nigerian Broadcasting Service, which was taking a great interest in the force. The Nigerian interviewing for N.B.S. found some difficulty in understanding how aircraft could fly without airscrews, and this mystification was found to be common among the local populace. Soon, however, they were to receive some measure of indoctrination by watching S/L. Bastard and F/L. D. F. B. Hall flying two Canberras over the route of the Sunday-morning fly-past, which was to take place near Lagos Cathedral.

But the squadron's main thoughts at this time were concentrated upon the fly-past which would take place at Ikeja just after the Queen landed in the Argonaut on the following day. Sir Harry Broadhurst, with the C-in-C. Southern Atlantic, and the G.O.C.-in C. West Africa, was to support the Governor-General, Sir James Robertson, in the greeting to Her Majesty as she stepped from the Argonaut, and the Force Commander would be among those presented immediately after the fly-past.

The ground crews, happily and hospitably housed by the Army in accommodation at a military hospital, were having a busy time on the Friday—preparing the Canberras; despatching Hastings No. 1 (which carried the advance party) to Freetown and Bathurst to deliver fuel pumps; receiving Hastings No. 2 with the rest of the ground staff and spares from Kano; and receiving the Canberra P.R.7 which was coming to take the C-in-C. back to United Kingdom on Sunday.

Among those who greeted the Canberras on their arrival from England were the president and chairman of the flourishing Nigeria Branch of the R.A.F.A., W/C. J. S. P. Phillips, D.F.C., and S/L. F. Ridout. The Branch was soon providing hospitality on a most generous scale for all ranks of the visiting force.

The Saturday's fly-past turned out to be successful in every way. In perfect formation the six Canberras saluted the Queen eight minutes after she stepped from her aircraft into the warm African sunshine and a brilliant and colourful scene. The immaculate two vics of three were at 800 ft and 250 kt. They had impressed the enormous crowds on and around the airfield with a mass cartridge start at 0910 hr and came in on time at 1008 hr, called by the Deputy Force Commander, W/C. A. A. N. Nicholson, from flying control.

Before landing they flew to the capital of the Eastern Region, Enugu, to demonstrate. Mist cut out some of the more spectacular items; but a cable from the Governor said, "All workers in Enugu downed tools for 20 minutes."

Lagos had not seen a demonstration and as it was thought that the local inhabitants might have been deceived by the "gentlemanly" fly-past for Her Majesty, W/C. Nicholson spent 5½ minutes on the N.B.S. radio newsreel on the Saturday night talking about the difference and assuring listeners that, though the display over the harbour on the following morning would be of a noisy character, it was quite safe.

A persistent mist, with patchy thin cloud down in places to 500ft, made conditions for the Sunday display marginal, to say the least, but the squadron decided to press on. Shortly after the Queen left Lagos Cathedral the six aircraft flew over in salute. Then, watched by Her Majesty and the Duke of Edinburgh from the high balcony of Government House on the Marina (sea front), the C.O. and F/L. Peter Thomas peeled off from the first fast run to do individual aerobatics, while the other four demonstrated in formation. The heat haze and the humidity, which was approaching 100 per cent, created vivid wing-tip trails, and condensation "shudders" that made a spectacular show even better. The initiated were full of praise for such a magnificent performance, especially in such conditions. But the effect on the Nigerians was electric. Their reactions were of joy, shouts of laughter and handclapping. They delighted in the fast low runs at 550 m.p.h., but most of all they favoured the C.O.'s superb climbs and rolls off the top and F/L. Thomas's spectacular manœuvres. The roar of the jets only seemed to add to the fun. It was a long time before the vast crowd on the Marina would disperse; they lingered, chanting "More!"

The Queen was reported to have been very impressed, and she charged Sir Harry Broadhurst to convey to the squadron her congratulations; and this he did when he went to Ikeja in the early afternoon to start his flight back to Benson in a Canberra P.R.7. In the afternoon the Canberras were lined up for inspection by the public and a vast crowd descended on Ikeja to ask some surprisingly searching questions on the mysteries of jet propulsion. The adjutant, F/L. Gordon Rondel, delighted them anew by an excellent show as part of an air test.

## THE WORK OF THE A.R.C.

*"Aeronautical Research Council. Review of the Years 1949-54." Published for the Ministry of Supply by Her Majesty's Stationery Office, London. Price 5s.*

THE last published review of the work of the Aeronautical Research Council dealt with the period 1939-48, although the Council has reported confidentially to the Minister of Supply since then. In this new publication, which appeared at the end of last year, a survey is made of the progress of aeronautical research on which the A.R.C. advises the Minister.

The chief subject of study, the Council reports, continues to be aerodynamics, with powerplants and aircraft structures coming next in importance. The Council's interests in research matters dealing with military aircraft have been expanded; work on naval and civil aircraft problems (including operational research) has continued; and the A.R.C. has kept alive an interest in helicopters and seaplanes. The Guided Weapons Advisory Board reports both to the Scientific Advisory Council and to the A.R.C., and the latter's technical committees have been instructed to take an increasing interest in matters discussed by the Board. Developments in materials and meteorology are being followed by appropriate committees, and a new committee has been formed to deal with computation.

Following an introduction in which matters of policy, equipment and research are discussed, the review deals in turn with trends in aerodynamic research; experimental techniques and facilities; aerodynamic theory; subsonic flow problems; problems of transonic flight; problems of supersonic flight; test facilities for aircraft engines; engines for jet lift; helicopter power plants; intakes; compressors; combustion; turbines; structures; flutter of aircraft; noise; materials; aerodynamic heating in high-speed flight; vulnerability and escape; computation; civil aircraft; naval aircraft; helicopters; seaplanes; gusts; the Commonwealth Advisory Aeronautical Research Council; and the publication of scientific papers. In appendices are listed the membership of the A.R.C. during the period under review; membership of committees, subcommittees and panels; and scientific publications.

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## NEW CF-100 FOR R.C.A.F.

A REPORT from Montreal says that the R.C.A.F. is to re-equip its home defence squadrons with the Mk 5 version of the Avro Aircraft CF-100. The Mk 5 has an operational ceiling some 5,000ft higher than that of the Mk 4 at present in service. A note on this new long-span version appeared in our "Aircraft Intelligence" page on February 3rd.

# SUBSONIC TO HYPERSONIC

## *An Outline of Problems to be Faced and Overcome. Part II*

LAST week (page 158) we published an abstract of the first part of a lecture read before the Institution of Mechanical Engineers in Derby by Mr. R. E. Creasey, an assistant chief designer of the English Electric Company. In the portion of the paper already abstracted, Mr. Creasey outlined some of the more general problems involved in the design of aircraft intended for high-subsonic, transonic and supersonic flight.

In the remainder of his paper he went on to discuss flight at still higher Mach numbers and altitudes and pointed out that although the "sound barrier" of a decade ago was now no longer regarded as such, the term "barrier" was justified when applied to the restrictions placed on maximum attainable speed by rise in temperature. Every component in an aircraft had a critical temperature beyond which it would fail. There was no clearly established Mach number at which components would fail, since this depended critically on the design and operating conditions.

A good approximation to the ram-temperature rise in degrees centigrade was given by $(V/100)^2$ where V was in miles per hour. Resulting maximum temperatures in the stratosphere were plotted in Fig. 1 in the more familiar terms of Mach number. This figure assumed a minimum temperature of −40 deg C which was seldom exceeded in the stratosphere below 100,000ft. This corresponded to a speed of sound of 685 m.p.h., and this was assumed in the remainder of the paper. The outer surfaces of an aircraft would always be rather cooler than the corresponding point on the curve, except in the vicinity of internal heat sources. Fig. 1 also showed the maximum temperature attainable by most of the aircraft's surfaces, even in the absence of radiation. This temperature rise through the boundary layer was actually rather less than 90 per cent of the ram rise and could be reduced still further.

Thin metal skins would heat up to these conditions in a matter of seconds. On the other hand the interior of heavy structural members or areas of non-metallic materials would take many minutes to reach even half the temperature rise from a previous flight condition or from the ground. The time lag increased approximately as the inverse of the atmospheric density and was therefore most significant at high altitude. Where high-speed endurance was limited (as in a fighter or guided weapon) it was economical to insulate the airframe rather than cool it. On the other hand, thermal lag was less acceptable as a protection for components of long-range aircraft or items which discharged considerable heat of their own.

Unless air-conditioned suits were always worn by the crew, the cabin was the first essential for cooling; this was closely followed in importance by many of the present forms of electronic equipment. As Fig. 1 showed, ram-air cooling was sufficient only for subsonic speeds. At supersonic speeds some form of refrigeration was essential, the simplest form being employment of a brake turbine. At moderate altitude this was sufficient, but compressor bleed air, cooled by a ram-air heat exchanger, gave more economical duct sizes at high altitude. For longer flights intake drag or engine power-loss had considerable effect on fuel consumption, particularly at higher Mach numbers. The situation could be improved by further initial cooling, either by a second air-turbine stage or a water boiler, but it was eventually essential to use the fuel as a heat sink. Engine oil already made demands on this, so it was necessary to insulate the fuel and all the electrical components from external heating.

In assessing the lightest system for a particular purpose it was essential to include the weight of insulation and of fuel consumed in overcoming additional drag (or loss in thrust). This was particularly important at increased Mach numbers when the total system-weight might become comparable with that of other systems. This was due not only to the increasing temperatures but also to the additional items demanding cooling, such as tyres and hydraulics. This emphasized the importance of raising the working temperatures of all items. This could be done by employing new materials and better insulation and by improving the design; for example, excessive miniaturization could increase the cooling requirements.

It was scarcely economical to refrigerate most of the primary structure, and the need for new airframe materials was therefore pressing. Aluminium alloys should still be primary structural materials where 100 deg C was not exceeded for long periods, but the weight of such a structure became disastrously uneconomical beyond about 150 deg C. If titanium alloys fulfilled all their present promise, the exchange of materials might not be at the expense of increased weight. An incidental advantage was that the low value of $E_s$ for titanium alloy might reduce thermal stresses. In extreme cases aluminium alloy might be employed for the cooler internal structure.

Much more experience was required with titanium alloys before full assessment was possible, and these materials also suffered from excessive creep at more than 350 deg C. Such temperatures also caused a marginal change in most existing stainless steels. Presently available stabilized stainless steels with practical working qualities became uneconomic beyond about 600 deg C, and further research would have to precede application of gas-turbine alloys to airframe structures. Where the structure was designed on a stiffness basis steel showed to greater advantage, but the airframe would need to be very flutter-prone before this could override other disadvantages. Another factor was that the use of denser materials necessitated considerable re-orientation of structural design to avoid buckling limitations, thermal stresses and creep problems, and a fairly advanced stage of design was necessary before assumptions could be made of panel buckling or minimum gauge considerations.

Considerable design ingenuity would be necessary in order to meet all the requirements within the acceptable total weight. Eventually, however, the structure would become impossibly heavy and, in this situation, further increase in Mach number would be possible only by cooling the structure itself. At low altitudes there was enormous transfer of heat from the boundary layer, but this was not true at high altitudes. Thus, even the amount of heat that could be radiated from the surface became significant. If the surface were painted to give the highest possible emissivity without disproportionate absorption from the sun, the limitations on titanium could be raised from M = 3 (350 deg C) to very considerably higher values. If structural alloys could be developed to accept 800 deg C, then radiation cooling became even more significant. Such cooling could be significant even for aluminium alloy, particularly if the theoretical possibility of stabilizing the laminar boundary was recognized at higher altitudes. Equally important, the equilibrium temperatures would be reached only after an appreciable time lag (which increased

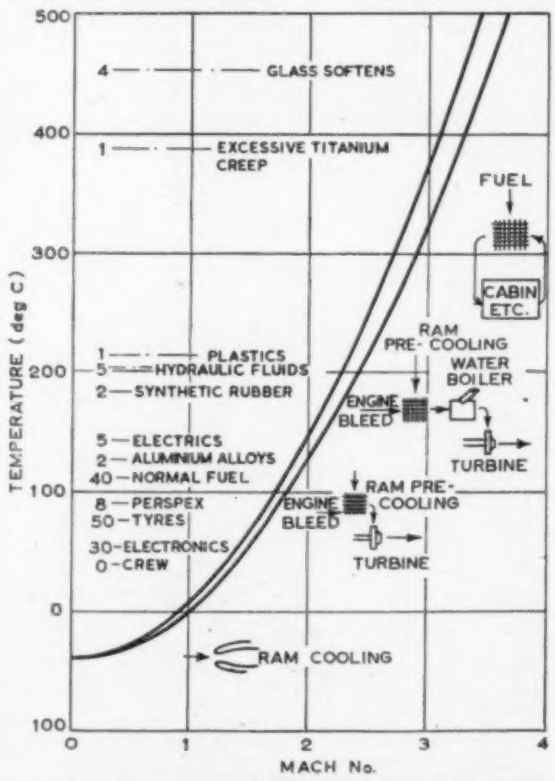



*Fig. 1 Ram temperature rise in the stratosphere plotted against Mach number. Temperatures at which various phenomena occur are indicated by the level at which half the final temperature rise is experienced in the number of minutes indicated.*

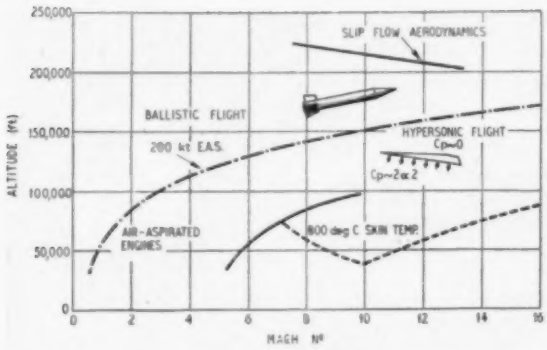



*Fig. 2 Some future flight regimes: the slip-flow region occurs above 500,000ft, where the free molecular path is equal to several hundred feet.*

rapidly with altitude at any given Mach number). Furthermore, the time required for terrestrial flights at higher Mach numbers became very brief.

Before too optimistic a view was taken of the possibility of flights at much higher speeds and altitudes it was to be remembered that the ram temperature at M = 10 was in excess of 4,000 deg C and that the heat transfer rates into the leading edge were much greater than for the surfaces further back. This heating could be reduced by increasing the leading-edge radius of curvature, sweepback or the altitude, but insulation or sweat-cooling through a porous skin might still be required. Furthermore, interior structure could not benefit directly from radiation, so it would be essential to seal off the interior and rely entirely on the fuel heat sink.

In addition to the thermal limitations, hypersonic flight posed other problems such as those included in Fig. 2. For example, the increased altitude resulted in a rapid reduction in the available aerodynamic lift at less than about 200 kts E.A.S., so that the size of wing required became uneconomic and it was necessary to resort to free ballistic flight. This curve also marked (approximately) the economic limit of air-breathing engines, and intake problems and ram-temperature rise also combined to eliminate the air-breathing engine beyond about M = 4.

For ballistic flight, or flight at hypersonic speeds, the rocket motor was essential and enjoyed indisputable advantages as the only powerplant which could operate independent of ram air or temperature. Although at normal supersonic speed the rocket was capable only of very short ranges, these limits would be largely removed when flight became possible at hypersonic speeds.

There was no universal definition of hypersonic speed, unless its lower limit were defined by M = fineness ratio, i.e. the hypersonic similarity constant of unity. At such Mach numbers there was a complete change in aerodynamic phenomena. The lift and drag developed by the upper surface of a wing became negligible. Physically, this could also be associated with the fact that at 150,000ft (near which hypersonic flight was possible at economic angle of attack) a complete vacuum was only 2 lb/sq ft below ambient. In contrast, significant forces could be generated by the undersurface when flying at an economical angle of attack. Rather strangely, said Mr. Creasey, they approximated to Newton for destruction of momentum normal to the surface.

Application of these principles should result in a complete change in aerodynamic design practice as envisaged by Sänger. The underside of the aircraft could form a planing surface of the requisite lifting area. Aspect ratio was unimportant so that—if the requirements of low speed could be ignored—all the lift could be obtained from the underside of an all-fuselage design. The top surface could be of any reasonable shape provided it was in the "shadow" from the stream direction over the leading edge. Sänger demonstrated theoretical L/D ratios exceeding six but design knowledge was at present nothing like complete. Gaseous imperfection, particularly dissociation, might have to be accounted for at the higher Mach numbers.

One certain bonus of such velocities resulted from the finite radius of the earth. Flying at constant altitude resulted in a centrifugal force opposing weight such that at 15,200 kts (roughly M = 25) all the weight would be supported in this way (this was the satellite velocity). This lift was of course independent of drag, so that range could be increased considerably. Sänger also considered the possibility of a hybrid flight path in which the aircraft skipped in and out of the denser atmosphere. Owing to the high accelerations and induced drag required to start each ballistic "skip," it could be shown that such a flight path offered no performance advantage over a simple glide from an initial ballistic launch. The real criteria governing the flight path depended largely on the heating problem and on whether the vehicle was to be retrieved at the end of its flight.

Aerodynamic laws changed even more fundamentally during ballistic flight at great altitude. Owing to the extreme reduction in air density the molecular mean free path increased to more than 0.01in at 200,000ft, so that it was no longer possible to neglect individual molecular motions. The first important consequence of this occurred in the boundary layer where the mean velocity between the surface and the air in contact with it ceased to be zero. Instead there was a complicated slip-flow at a velocity dependent on the molecular structure of the surface.

Above 500,000ft [North American Aviation are at present building a piloted aircraft to explore altitudes up to 520,000ft—Ed] the mean free path increased to many hundreds of feet and it was necessary to consider individual molecululars collisions with the surface rather than with other molecules of the atmosphere. The result was high drag-coefficients and low lift-coefficients, but the actual aerodynamic forces and heating might be neglected except for the cumulative effect on bodies stabilized in orbits. If the denser atmosphere were to be re-entered at hypersonic velocity the aerodynamic forces and heating would be enormous.

The extreme velocities required for sustained ballistic flight could be obtained only with a large rocket motor using a great amount of fuel. The attainable "muzzle velocity" depended largely on the mass ratio of initial weight divided by final weight (after consuming the fuel). Were this ratio to be two a large rocket booster could give a speed increase of "only" 2,000 or 3,000 kt, which would be completely useless; the elimination of wings and heavy air-breathing engines should allow some improvement, but the German V-2 achieved a mass ratio of three only by reducing its payload to a much smaller percentage than that acceptable for normal aircraft.

A favourite trick for improving the final velocity was the use of multiple stages; for example, three stages each with a mass ratio of three gave the equivalent of a single vehicle with a mass ratio of 27. Where the cost was justified there was little doubt that any required ultimate velocity could eventually be obtained in this way, although the final payload would be microscopic in proportion to the size and cost of the whole system. Such principles could also be applied to normal aircraft, and would be particularly advantageous with supersonic aircraft whose ideal shape was quite different from that required for subsonic flight. It was a straight mathematical problem to translate high velocities into ranges around the earth or flight into space, and Fig. 3 summarized some results for the simple ballistic case. The ranges obtained from launching at the optimum (for low velocities) 45 deg could not compare with those of long-range aircraft until the "muzzle velocity" was a large percentage of the satellite velocity of 15,200 kt. Maximum range was thus obtained on a much flatter trajectory and rapidly increased to 10,800 nautical miles (half the circumference of the Earth). If slightly higher velocity could be obtained, the vehicle could be made to act as a satellite; and with 40 per cent greater velocity the satellite could release itself from the earth's gravitational field entirely. The required increase in velocity could be reduced by nearly 1,000 kt if the maximum advantage was taken of the earth's rotation by launching to the east from the equator.

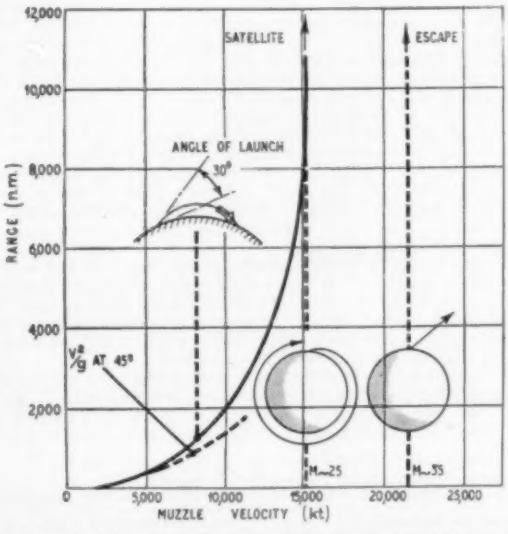
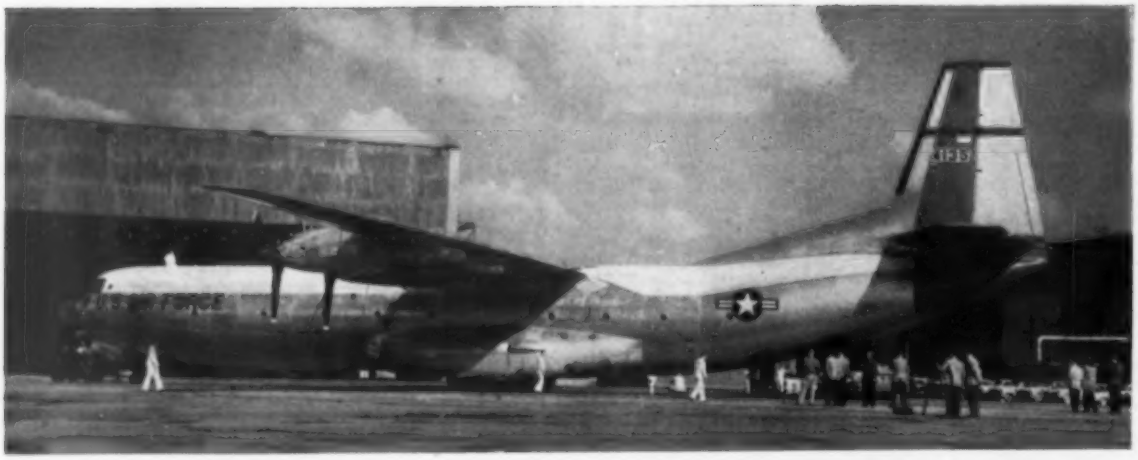



*Fig. 3 Some ballistic ranges from the earth, showing the velocity escape.*



*In spite of its impressive size the Douglas C-133, illustrated on this page, will eventually be eclipsed by another U.S.A.F. transport from the same stable: the C-132, with four T57 turboprops and over 100,000 lb payload. Another view of the C-133 appeared last week.*

# DOUGLAS C-133

ON the last day of January the Douglas Aircraft Company rolled out the first C-133 from their Long Beach factory, and there seems to be justification for claiming this as the most capable large military transport aircraft yet built.

It is the successor to the C-124 Globemaster, of over 440 of which the last was delivered from Long Beach last summer. The new machine differs from the Globemaster in all major aspects: it is much larger; it has turboprop power; it has a high wing; and it is pressurized. It is, in fact, designed to the same formula as was the smaller Lockheed C-130 Hercules; and one can hardly accuse Long Beach of plagiarism in view of the fact that this type of aeroplane seems, for the duties prescribed, logical and correct.

Although performance requirements have led to a slimmer fuselage than that of the C-124 there is more usable volume than in any other aircraft ever put into civil or military service, apart from the lone Convair C-99. Over 90ft of floor is devoid of obstruction and access is through side doors and also through the stern opening shown in one of the photographs. The latter is identical in geometry to that of the C-130 and can be opened in flight for heavy dropping. Fuselage diameter is 16ft 2in.

Choice of a high wing has allowed the floor to be placed at truck-height (4ft 2in) and should have incurred no weight penalty. It does, however, necessitate an unusual form of landing gear and this is a variation on the C-130 theme. Twin, hydraulically steerable, nosewheels retract forward and the main units comprise four-wheel bogies which lift vertically into unpressurized blisters. The legs themselves are short and attach to the two strongest frames in line with the wing pick-ups. In the C-130, these blisters also house the cabin-conditioning equipment; in the Douglas there is room for much more besides. Among the equipment so disposed are heating units with a combined output of approximately 900,000 BThUs per hour and gas-turbine air compressors for engine starting. In normal operation the crew will comprise pilot, co-pilot, navigator and "systems engineer," and quarters are included for a relief crew.

Power is provided by four Pratt and Whitney T34-P-3 single-shaft turboprops rated at 6,000 e.h.p. each. They are installed in finely profiled cowlings underslung from the wing, with the oil coolers on top. Air for the engine is taken in around the spinners of the three-blade 18ft Curtiss airscrews and discharged from nozzles on the underside of the nacelles.

The wing employs tapered skin including one inter-spar section 58ft long on each wing (these skins had to be coiled in order to heat-treat them). Integral tankage is provided for 16,800 U.S. gal. High-lift flaps run out from the wing on guide rails to provide good take-off performance (6,000ft strips should be ample). The control system is almost certainly manual (that was the design aim) and geared tabs are fitted. A standard item is the search radar for cloud warning and ground painting.

A production contract for C-133As was placed in 1954, and the first batch of aircraft is well advanced. Most of the ground testing necessary has been completed on rigs, and flight trials of the first complete aircraft—it is looked upon as a production machine—may have begun by the time this issue appears, although a considerable ground programme remains. The target, set 18 months ago, was March 1st. The table below shows what the C-133 could do for any commercial operator able to find enough traffic to fill it.

**Douglas C-133A** heavy military transport, powered by four 6,000 e.h.p. Pratt and Whitney T34-P-3 turboprops. Span, 179ft 8in; length, 148ft 2in (152ft 8in over radome); height to tip of fin with undercarriage depressed by full load, 48ft; normal payload, 80,000 to 83,000 lb; range with maximum payload, up to 1,800 miles; maximum weight, 255,000 lb (may be 275,000 lb); maximum cruising speed, over 350 m.p.h.

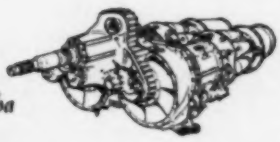
| Direct Operating Cost (dollars per short-ton nautical mile) | | |
|---|---|---|
| | 1,000 n.m. | 2,000 n.m. |
| Douglas C-133A | 0.042 | 0.053 |
| Lockheed C-130A | 0.053 | 0.059 |
| Douglas C-54 | 0.096 | 0.132 |
| Fairchild C-119 | 0.162 | 0.650 |

# search–

# strike!

TARGET AHEAD and the range closing. The hunt is nearly over as the Gannet comes in for the kill. Long range and new radar have combined to find and fix the enemy. High speed, manoeuvrability and unrivalled field of view, combined with the most formidable modern weapons, enable the Gannet to strike, and keep on striking until the enemy is destroyed.

*Powered by the Armstrong Siddeley Double Mamba*



# FAIREY

## GANNET

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# 40,000 ft. apart

Squadron Leader J. S. Fifield, D.F.C., A.F.C., by a recent successful ejection at ground level, demonstrated the capability of the latest Martin-Baker fully automatic ejection seat to bring about safe escapes near the ground at low forward ejection speeds. A further important requirement of an ejection seat lies in its high altitude performance. Martin-Baker fully automatic ejection seats are designed to bring the seat occupant safely down from the ejected altitude, stabilised and under control, to a selected altitude at which parachute deployment and separation of the occupant from the seat is automatically performed.

The altitude of the live ejection demonstrated at Chalgrove on October 25th was over 40,000 feet, and the altitude of separation 10,000 feet.

**Martin-Baker**

AIRCRAFT COMPANY LIMITED

***Said to have been taken during the diving tests described in the first paragraph below, the photograph on the left shows a Lockheed R7V-2 turboprop transport of the U.S. Navy. Maximum cruising speed is about 440 m.p.h. The second picture shows a Max Holste 1521 Broussard light military transport, a counterpart of the de Havilland Canada Beaver, for the French Air Force. A pre-production batch of 27 is now being completed.***

# AIRCRAFT INTELLIGENCE

## U.S.A.

*Lockheed R7V-2.* This U.S. Navy version of the Super Constellation, powered with Pratt and Whitney T34 turboprops of 5,700 h.p., has achieved 479 m.p.h. in "rapid-descent testing" over California. The pilots, R. E. Wimmer and J. F. Ware, attained this remarkable speed (for an airscrew-driven transport at least) in a descent from 25,000ft to 8,000ft at an angle of about 20 deg and on low power. In another test the R7V-2 has been flown at a gross overload weight of 166,400 lb—about 11 per cent above normal and twice the weight of the first Constellation, flown in 1943.

*North American F-100D Super Sabre.* The first flight tests have been completed of this new model of the F-100, equipped with an automatic pilot developed expressly for supersonic flying. Mr. Dan Darnell, North American test pilot, is quoted as saying, "This enables the pilot to concentrate on navigation or other tactical phases of his mission. It greatly reduces the chances for human error in split-second timing required at these speeds".

## France

*Bréguet 965 and 1050.* The Bréguet 965, a "flying mock-up" incorporating installations for the French Navy's forthcoming Bréguet 1050 anti-submarine aircraft, recently completed its official tests and will now be taken over for tactical experiments. The pre-production Bréguet 1050s are progressing "actively" at Toulouse, and the first of the batch should be on test at the end of the summer.

*S.N.E.C.M.A. Flight Testing.* More than a thousand hours of test flying are being completed annually by a wide range of machines used for the air-testing of S.N.E.C.M.A. powerplants. The aircraft include Martin B-26, S.O.30P, Languedoc, Mystère II and IV, and Vampire.

*S.O.1221 Djinn.* The sale of three Djinns to the Argentine Republic has been confirmed and a second delivery will shortly be made to Switzerland. A mission organized by S.N.C.A.S.O. for market research in Central America left France at the end of last year and has been demonstrating the Djinn in conjunction with the International Peace Fair at Ciudad Trujillo, capital of the San Domingo Republic. This same machine is now in Venezuela and is to be demonstrated in other Latin and Central American countries. The first prototype of the S.O.1221 has now completed more than 500 flights.

## Italy

*Macchi B.326 Jet Trainer.* The Macchi company has displayed a mock-up of this new low-mid-wing, tandem two-seater basic jet trainer, to be powered by an Armstrong Siddeley Viper ASV.5, or later variants of this engine, giving up to 2,200 lb thrust. To accommodate these later units the intakes and jet pipe can be enlarged without major structural alterations, and slight aerodynamic refinements could considerably raise the critical Mach number. Wing and tailplane have a slightly swept leading edge and straight trailing edge; fin and rudder are fully swept. The nosewheel undercarriage, plain flaps and air brakes extending under each side of the rear fuselage are hydraulically operated. Pressurization, V.H.F. radio and A.D.F., full blind-flying instrumentation and coloured screens, and Martin Baker Mk 4 lightweight ejection seats are standard equipment. A gyro gunsight is provided and armament loads can be made up from two S.A.F.A.T. 7 mm machine guns with 200 rounds each; four 13.2 lb practice rockets or four 62 lb rockets; four 33 lb practice bombs or four 100 lb bombs. Fuel capacity is 172 gal in the fuselage and 35 gal in each of two jettisonable tip-tanks. Span and length are, respectively, 31ft 6in and 33ft, wing area 196.9 sq ft, and empty and maximum all-up weights are 3,810 lb and 5,750 lb. Estimated maximum sea-level speed is 407 m.p.h., and sea-level rate of climb 3,050ft/min. Minimum speed with flaps should be 82 m.p.h. and endurance with wing tanks at 29,600ft 3 hr 6 min. Designed limiting Mach number is 0.8.

## Afghanistan

*Gift of Il-14.* The Soviet Ambassador in Kabul has handed over an Ilyushin Il-14 twin-engined transport aircraft to King Zahir Shah of Afghanistan. The machine is a gift from the Soviet Government.

## Egypt

*Gift of Aero 45.* The Czechoslovak envoy in Cairo has handed over an Aero 45 twin-engined four-seat light aircraft to Premier Nasser as a gift from the Czechoslovak Government.

## India

*Gift of Glider.* The Polish Government has presented to Premier Nehru a Jaskolka high-performance glider as a gift from the Polish nation. It is learned also that a team of Polish glider pilots has just returned to Poland from India, where they have been touring the country giving gliding demonstrations and familiarization flights and, incidentally, collecting orders for Polish-built training and high-performance gliders.

## Austria

*Austrian Air Force Equipment.* The Austrian Air Force has recently received eight new Yak-11 and Yak-18 trainers as a gift from the Soviet Union. They are stationed at the Tulln-Langenlebarn airfield, north of Vienna, and on a recent television programme were seen in company with Harvards. It is expected that the Austrian Air Force will eventually receive North American F-86s and Lockheed T-33s in addition to Mig-17s.

## Rumania

*New I.A.R. Types.* The first Rumanian aircraft built specifically for "medical and agricultural purposes" were completed recently. They are the twin-engined IAR-814-MR2, described as having a retractable undercarriage and "consumption of only 5 litres of fuel per 100 km", and the IAR-817, a single-engined machine with nosewheel undercarriage and blind-flying panel. The 817 is to be used for "postal traffic, fish spotting, agricultural spraying and glider towing."

# CONVAIRIANT

FOLLOWING what now seems to be an established aeronautical practice, one might describe this airliner as a turboproselyte, in view of its conversion from piston to turboprop power. It is a fully furnished Convair 340 in which, for demonstration purposes, the 2,400 h.p. Pratt and Whitney R-2800s have been replaced by 3,000-e.h.p. Napier Elands. The conversion was made by Napier's Luton establishment. The aircraft was then ferried to the College of Aeronautics at nearby Cranfield, where trials began on February 9th. It was on that occasion, with Napier chief test-pilot Mike Randrup at the controls, that the accompanying *Flight* photographs were taken. A full, illustrated account of the project was published in *Flight* of February 3rd.

## NEW D. ARM. R.D. (AIR)

IT is announced that the Minister of Supply, with the agreement of the Secretary of State for Air, has appointed G/C. R. H. E. Emson to be Director of Armament Research and Development (Air) in succession to A. Cdre. H. Ford. G/C. Emson will be granted the acting rank of air commodore on taking up his new duties.

## AVRO CHIEF ON PRODUCTION

TO get a modern aircraft into production and into service in ten years of hard work would be "doing a good job," in the view of Sir Roy Dobson, managing director of A. V. Roe and Co., Ltd. He expressed this view last week in an address to the Manchester Publicity Association, to whom he gave some examples of the amount of development and test work involved. He instanced the powered controls of the Vulcan, which had been operated on test rigs for some 1,500 hr before installation in the aircraft; the hydraulic system, which had been rig-tested for 2,000 hr; and landing gear, which had been raised and lowered about 2,500 times. Whereas his firm once employed 50 draughtsmen, today it had over 1,000; ultimately this number would have to be nearly doubled in order to get through the projects in hand.

Remarking that modern supersonic aircraft were "nearly all straight lines," Sir Roy said that he was old-fashioned enough to believe that one day, when the aerodynamicists had learnt more than they knew at present, the curves would begin to come back.

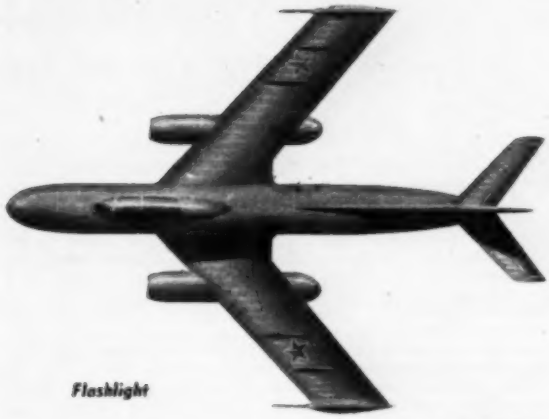
After discussing the present state of the aircraft industry, Sir Roy ended with a criticism of the Press—presumably the newspapers—for "many unjustified attacks" on the aircraft industry. In the United States Press, everything said about American aircraft was wonderful, and this was reported all over the world, thus helping to sell aeroplanes. The British Press "put in everything bad about this country's aircraft, and the foreign customer saw it and reacted to it." Sir Roy went on to instance criticism of the Hunter's gun installation, saying that trouble had been cured but that the publicity had "done a lot of harm and had lost the firm a contract."

## FRENCH ENGINE NEWS

AGREEMENT has now been reached between Hispano-Suiza and Turboméca in the establishment of a new company which is to carry out development work "in all fields relative to the application of turbines as well as their production." The two firms will be jointly responsible for the technical and financial direction of the new organization.

It is also announced that a Turboméca Gabizo turbojet successfully completed the French Air Ministry 150-hr type-test in December, stripping in excellent condition. This engine, which was exhibited at last year's Paris Salon and described in *Flight* of June 17th, 1955, is a neat centrifugal engine with a maximum thrust of 2,420 lb.

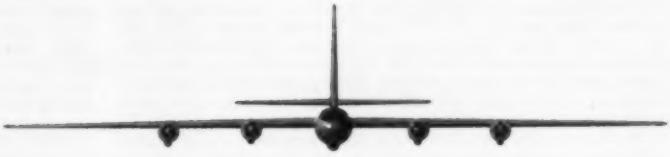
Farmer



Flashlight

# Farmer, Flashlight, Bear

## *New Drawings of Russian Jet Fighters and a Turboprop Bomber*



THE *Flight* copyright drawings on this page—the work of D. I. Punnett—are based on new official silhouettes and exhibit more authentic detail than hitherto associated with the types concerned.

The day fighter Farmer (all three types are provisionally designated according to the Allied nomenclature code) will be seen to bear a certain resemblance to the North American F-100 Super Sabre and to the French Marcel Dassault Super Mystère, and is almost certainly capable of supersonic speed in level flight. About 50 of these clean-cut fighters flew past at the Tushino display last year.

Flashlight is a two-seat all-weather fighter in the class of the S.N.C.A.S.O. Vautour, and is powered with two axial-flow units of, perhaps, 8,000/9,000 lb thrust. The main undercarriage is of "bicycle" type (as on the Vautour) and there are retractable wing-tip outriggers. Two heavy-calibre guns are in evidence and the radar nose is of massive proportions. Flashlight fighters made their first appearance in public at Tushino last year.

The Bear is a turboprop bomber strongly suggestive, in plan form at least, of the Boeing B-52, and having, in common with other Russian bombers, tail armament. Span is about 145ft, and the Bear is thus considerably smaller than the pure-jet Bison (175ft approx.) The pronounced sweep-back of the horizontal and vertical surfaces is suggestive of high speed—probably in excess of 450 m.p.h.—and the tails of the inboard engine nacelles might house remotely controlled armament in addition to the main undercarriage wheels.

Bear

# No. 18 SQUADRON

## *A Bomber Command Unit with a Remarkable History*

**PART III**

By JOHN YOXALL

ON July 27th, 1943, No. 18 squadron began its move to Sicily. The airfield at Gela West, renamed Manji Lungo, was found unsuitable for flying and the Bostons used Ponte Oliva until August 8th, when a move was made to Comiso. Targets, of which there was a wealth, were by now mostly on the Italian mainland and in the Straits of Messina, across which the Germans and Italians were retreating. Night operations ceased, however, on August 18th and on the 21st a further move was made, to Gerbini 3. Although there was now little resistance by enemy night fighters, very few of the Bostons returned without flak damage of some sort—chiefly because their machine-gunning was conducted at zero altitude.

Nine Bostons were ordered for night operations against the marshalling yards at Battipaglia, the first of the aircraft to act as pathfinders. This was part of a very big scheme to wreck entirely the enemy railway system. Battipaglia was completely demolished.

For the first operation from Gerbini 3, six Bostons were detailed for a night attack on gun positions north of Reggio Calabria. No opposition was encountered, but Boston H crashed three miles from the airfield shortly after take-off, F/O. K. Arthur and his crew being killed. The gun positions and other military emplacements remained the squadron's chief targets for the rest of the month.

September opened with further heavy attacks on the marshalling yards at Battipaglia and other towns on the Italian mainland. The writer had an opportunity to visit Battipaglia shortly after these attacks, for which No. 18 Squadron had acted as pathfinders, and he can vouch for the effectiveness of the bombing. There was not a yard of rail which had not been torn from its anchorages.

To support the invasion of the mainland, which had started on the night of the 2nd, maximum effort was ordered. On the night of the 6th the marshalling yards at Altamura was the target for the eight serviceable Bostons (out of 15) and the pathfinders' incendiary bombs were accurately placed from 700ft in a long stick across the yards. One aircraft machine-gunned the target with 1,500 rounds from 200ft and while doing so was hit by a 4 lb incendiary from a Boston above; the bomb went clean through the T.R.9 radio set. Officially the maximum effort lasted until the 11th, but the end of the period made little difference, for until September 25th eight to ten Bostons were operating each night in the area affecting Salerno. Leaflets as well as bombs were dropped.

An operation on the night of September 16th is typical of the period. Three Boston DB-7s took-off at 0200 hr to "pathfind" Caserta. The target was clearly illuminated with 48 × 30 lb and 540 × 4 lb incendiary bombs dropped from between 4,000ft and 5,500ft during the period 0336 to 0345. The bombs fell in a cruciform pattern across the town from north to south and east to west. After the target had been illuminated high-explosive bursts were seen to cause two big explosions and two substantial fires, one of which latter was visible for 40 miles. Over the whole length of the main street the electric supply cables and pylons could be seen short-circuiting. No defences were in evidence, but on the way home one Boston encountered a Ju88 at 8,000ft. The Junkers made two attacks but both were foiled by the Boston, whose pilot made sharp diving turns to port. No. 18's aircraft all landed safely at 0540-0550 hr.

The rest of September was spent in training new aircrews and preparing to move at short notice to the Italian mainland. The commanding officer, W/C. D. C. Sandeman, was awarded the D.F.C.

October started badly. The squadron was still at Gerbini, but on the 2nd a severe storm blew all the tents down and the squadron personnel had to be accommodated in local farmhouses. The airfield was out of service for nearly a week.

The projected move to the mainland came on October 7th, when the unit's 16 Bostons flew to Brindisi—though congestion there made it necessary for six of them to return temporarily to Gerbini. The move represented a welcome change for the personnel, who had been under canvas nearly the whole of the time since their arrival at Blida; officers and aircrew were quartered in a block of flats and the men in huts. Operations were resumed on the 9th when eight aircraft took off, two as pathfinders. On the next day Cassino, the town which held up the Allied advance for so long, was the squadron's target for the first time.

Bad weather persisted throughout the month and on at least two occasions Bostons got out of control owing to severe icing. Nevertheless, operations were flown, usually by ten aircraft each night—which meant that the aircrews were on duty two nights out of three. The month saw a temporary change in command; W/C. Sandeman went to hospital at Bari on the Adriatic coast and was replaced by S/L. A. W. Eller, D.F.C., an old 18 Squadron man who had been posted temporarily from H.Q. T.B.F. The month ended with a move to Foggia, when the unit came under the control of No. 232 Wing—the other squadrons of which were Nos. 55, 223 and 114.

From Foggia operations were flown against strategic targets on the eastern side of the Adriatic, seven Bostons and one A-20C (A-20 was the American designation of the Boston) being used for the first attack from the unit's new base against the harbour at Zara. Aircrews preferred this type of operation to the night armed reconnaissances which formed the major part of the squadron's work.

By November 11th, 1943, the squadron had completed a year overseas and in that period had made 1,145 sorties, 1,008 of which were successful and 120 abortive. Time flown totalled 2,909 hr and 1,463,530 lb of bombs were dropped.

W/C. Sandeman, having recovered from his illness, returned to the squadron on November 17th, two days before a maximum effort was requested to aid a big attack projected by the British 8th Army. Bad weather, however, was seriously to curtail all operational flying until the end of the year. The commanding officer again left the squadron, this time to go to a new appointment, and Maj. L. L. Gordon, D.F.C., of the South African Air Force, took over on December 16th. Airfield unserviceability and the need to overhaul aircraft gave the squadron a quiet period during the second half of December.

The new year of 1944 opened with operations, mostly night armed reconnaissances again, carried out despite appalling weather. Several times the airfield became unserviceable, too bad

*(Left) The sea of mud at Falconara in 1944 which for a long period prevented the squadron's Bostons getting from dispersals to the runway. (Right) This photograph of Battipaglia bears grim testimony to the effectiveness of Allied bombing. The town of Battipaglia and its marshalling yards were frequently on No. 18 Squadron's list of targets.*

even for training and check flights without war loads to be made. Some idea of the conditions prevailing at the time can be gathered from the record for January 14th. On this day eight aircraft were detailed for armed recce. in the Rome area; but after the first four had taken off it was realized that the weather was quite impossible, and the remaining aircraft were kept on the ground. Of the four pilots who got away, the first, Lt.-Col. Gordon, returned with his bombs; the second F/Sgt. Dannat, came back owing to generator failure; and the third, F/Sgt. Perry, crashed when attempting to land, his crew being injured. The fourth, F/Sgt. Gibbon, was returning home on one engine when things became so difficult that it was decided to abandon the aircraft. The navigator and the two air gunners baled out, but Gibbon was killed.

Yet even in these conditions there was no falling-off in keenness. One reads in the squadron diary of such incidents as S/L. Eller's Boston being bogged during take-off—"but, with good co-operation from the ground crew, another nosewheel was rapidly fitted and he took off later."

During the month no fewer than four Bostons were lost despite the fact that some of the operations were flown from Pomigliano, where better weather prevailed.

Again in February the bad weather either caused sorties to be cancelled or rendered sterile those which were flown. At this time the unit was working very closely with No. 114 Squadron, the operation of the two units sometimes being under the control of Lt-Col. Gordon and at other times under W/C. Thompson, who commanded 114.

Strategic bombing was off for the moment and night armed reconnaissances were again the main occupation. On the night of February 9th there was a welcome change when the target was an assembly of enemy tanks in a wood. Ten aircraft were detailed, of which nine took off, one being bogged. The C.O., who was first back from the raid, ordered double sorties where possible, and four others took off with him for a second attack. The whole affair was most successful, especially in view of the fact that the unit was in the middle of moving from Foggia to Marcianise.

March provided another tale of persistent bad weather, and, unfortunately, a number of losses as a result; but April opened with better conditions and a welcome change to shipping targets. Most of the railways south of Florence had been cut and it was known that the enemy were bringing supplies by small ships. A standing target was San Stefano harbour. Plenty of shipping was seen, and at first near misses were scored. The first certain success came on the 7th, when F/L. Dannat on "D" scored a direct hit on an F-boat.

Later in the month some of the Bostons were detailed to create road blocks in order to restrict enemy motor transport movements in the battle area; and there was also some spectacular co-operation with the Army, effected by lighting-up targets for the artillery. A total of 188 sorties constituted a record for the squadron while serving in Italy.

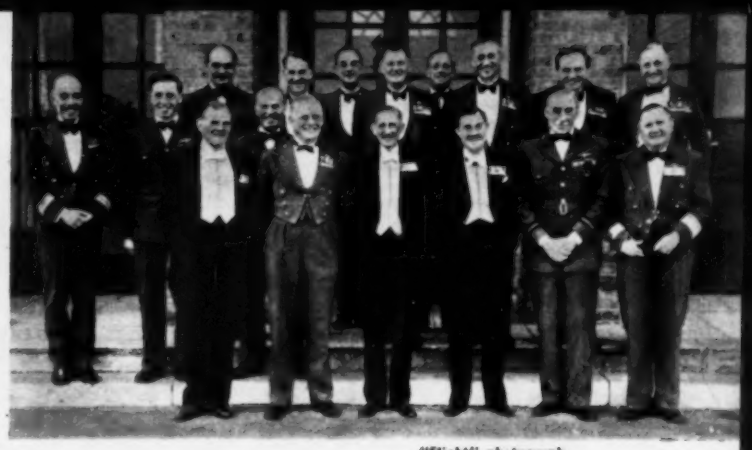
The squadron nearly lost its commanding officer on the 14th when "X", the Boston he was flying on an armed recce. against the Cassino-Rome-Avezzano roads, crashed in the sea near the island of Ponza. Lt-Col. Gordon was picked up by an Italian fishing boat some hours after ditching, and the navigator, F/L. Moisley, who had baled out, was rescued after spending six-and-a-half hours in his dinghy. A result of this crash was a squadron lecture on air/sea rescue and the use of dinghy equipment.

During the month some new A-20Gs were collected. With these aircraft on charge, and through the need to support the Army push, which started in the middle of May, the average number of daily sorties rose to about eleven. The greatest excitement came on the 16th when information was received from Intelligence that the 26th Panzers might be leaving Valmontone and moving down Highway 6. The squadron was to verify this news and report back in code for others to join in a Panzer strafe. A positive report was sent, but some "typical pro-German weather" prevented the hoped-for results being obtained. One Boston was lost. Squadron sorties for the month went up to 270.

Certainly the weather in 1944 seemed a bias towards the enemy for even in June it was still appalling. The squadron moved on the 14th to La Banca, but was grounded for several days owing to airfield unserviceability. Conditions were so bad that on the 26th a further move was made to Tarquinia. Apart from the original necessity for the move it was found that aircraft taking off from north to south at La Banca were often shot at by our own guns at Anzio.

June had been a month of movement. The 5th and 8th Armies had captured Rome and advanced far beyond that city. Every effort possible was made by the squadron to interdict retreating traffic in the rear of the enemy but many sorties were either badly hampered or rendered abortive by bad weather. On one occasion when the weather was good a Beaufighter, making an emergency landing, spread itself across the runway and prevented further flying for a while.

The Boston A-20G, with the navigator in the rear, was found to be very limited in its operational use and those on charge were returned to the Americans. As replacements a supply of A-20J (Boston 4) aircraft were promised. Command of the squadron passed from Maj. Gordon to W/C. Passmore.



"Flight" photograph

*At the squadron guest night held in July, 1954. Left to right:— Front row:* A. V-M. Sir Ronald M. Reid, K.C.B., D.S.O., M.C.; S/L. R. A. Cooper, M.B.E.; G/C. G. I. Carmichael, D.S.O., A.F.C.; A. Cdre. G. S. Shaw, C.B.; A. Cdre. H. E. Farrow, C.B., O.B.E.; A. V-M. W. A. Opie, C.B.E. *Middle row:* S/L. J. E. W. Le Gras; S/L. G. Young; F/L. C. H. J. Clampitt. *Back row:* S/L. S. S. Dobbs; W/C. D. C. Sandemann, D.F.C.; S/L. F. Rothwell, D.F.C.; G/C. K. W. Niblett, D.F.C.; W/C. D. C. Smythe, D.S.O., G.M.; G/C. D. J. P. Lee, C.B., C.B.E. (Station Commander at Scampton, where the function was held).

In contrast with June the month of July was continuously successful. Almost every night nine or ten of the squadron's Bostons were out on armed reconnaissances and finding plenty of targets. Unfortunately several aircraft were lost, including one fitted with four 0.5in guns depressed at an angle of 12 deg. This Boston (543-9646) was on loan from 47th Bombardment Group, U.S.A.A.F. The guns were under control of the pilot, but the system was not a success, because the pilot was unable to see his strikes. The aircraft was flown by F/L. Barnes who, with Sgt. F. T. Oliver, was killed.

The Boston 4s now began to arrive, but so many modifications had still to be incorporated that the Mark 3s were kept in service. During the month a move had been made to Cecina.

August opened well, with a successful attempt at destroying a pontoon bridge carrying the retreating enemy across the River Arno. S/L. Eller attacked first. His bombs were seen to fall on the north bank, bringing down buildings and causing a road block. F/Sgt. Gifford, coming in next, scored direct hits on the centre of the bridge; and into the smoke from these explosions went the bombs from W/O. Ashton's aircraft. The destruction of the bridge was confirmed the next day.

Halfway through the month the invasion of the south of France took place and for a few nights the squadron flew sorties in support of the ground troops. The advance was so fast, however, that the area of operations soon passed out of the operational range of the Boston. Interest was re-centred on more armed reconnaissance in Italy in support of the army's attack on the Gothic Line. Operational sorties totalled 227, in which 119 tons of bombs were dropped.

A feature of September's work was the attacks made on close-support targets immediately in front of our own troops. These attacks called for extreme accuracy and it was found necessary to send pathfinding aircraft to mark the exact area with incendiary bombs. Operations were hampered by extremely heavy thunderstorms which sometimes put the Cecina airfield out of commission for three days at a time.

Remembering the sunny weather for which Italy is famed it is almost unbelievable to read in the squadron diary of impossible conditions yet again in October. They were so bad that only 36 sorties could be flown during the whole month. The C.O.'s monthly summary contained this pointed comment: "The aircrew made themselves busy by carting broken bricks, gravel, etc., to make paths and roads on the camp site to prevent it becoming a morass—they now know why aircrew are in what is called the 'General Duties Branch' of the Royal Air Force." The site referred to was at Falconara, whence the squadron had moved on October 14th.

*Wearing the squadron badge once more: A. V-M Sir Ronald M. Reid (left) and G/C. G. I. Carmichael (right) with S/L. R. A. Cooper before flying in Canberras.*

"Flight" photograph

"Flight" photographs

*(Left) Present members of No. 18 Squadron with their Canberras lined up at Upwood, where the unit is based. (Above) S/L. A. H. Chamberlain, who now commands the unit, with his flight commanders; F/L. D. H. Bennett (who was the pilot of the Canberra from which the photograph on the opposite page was taken) and, right, F/L. R. E. Abbott.*

## NO. 18 SQUADRON . . .

The tale of bad weather and airfield flooding persisted into November. In desperation Italian labour was brought in to lay concrete at the dispersals; but the first two Bostons which moved on to it, on the 15th, promptly went through up to their axles and had to be pulled out by a mobile crane. It was not until the 20th that a full quota of nine aircraft were able to taxi out from dispersals in order to operate over Yugoslavia. Armed reconnaissance flights were made over Sarajevo—the town in which the murder of Archduke Francis Ferdinand of Austria and his consort was committed, on June 28th, 1914, the incident being seized upon by Germany as an excuse to start the first World War.

Though a few more sorties were flown to assist the 8th Army, November was in fact another month of frustration. Only 44 sorties were flown; yet, remembering the mud, bad living conditions and congestion at Falconara, this total represents a terrific achievement.

There was some let-up in the bad weather during December, but the legacy of mud from the previous month caused trouble with undercarriage legs, which failed to lock down. From this cause two Bostons had to crash-land. Thereafter it became standard practice to clean the undercarriage locks at the beginning of the runway immediately before take-off.

The closeness of the Russian forces coming from the east now made it impossible to operate with safety over Yugoslavia, so the squadron's attention was turned to Italy once more. Sorties totalled 119. On Christmas Day, in spite of all the squadron's troubles and the fact that they were expected to provide eight aircraft for that night, the celebrations were in traditional style, officers and senior N.C.O.'s waiting on the men in the airmen's mess.

In the latter part of January, 1945, W/C. A. K. Passmore became tour-expired and left to become Senior Air Staff Officer of No. 253 Wing. Command of No. 18 was assumed by S/L. V. Rees, who was later granted the acting rank of wing commander.

Snow now took the place of rain and by the 28th it was lying six inches deep at the dispersals. It was during January that the first Gee equipment arrived and lectures were given to all navigators concerning its use. Sorties for the month were mostly against road and rail targets in the Po Valley but, in addition, several close-support attacks were made, the aircraft acting under ground radar control.

In the first ten days of February only one Boston operated; F/L. H. H. Cole-Baker found conditions so bad that he had to jettison his bombs and return to base. On the night of the 10th eight operated; then there was another period of more than a week during which no ops. could be flown, for the rain and snow of previous months had now given way to fog.

"Flight" photograph

*Preparing for flight a Canberra which has spent a frosty night at dispersal is a cold job—another picture from Upwood.*

At long last, in March, came better conditions. The squadron moved to Forli, where the state of the airfield, if not of the billets, represented a great improvement over that of Falconara. Operations, of which a total of 236 were flown, were mostly against road and rail targets in the foothills of the Alps.

By April, 1945, there was a noticeable change in outlook and this is reflected in the squadron diary. Although as many as 20 sorties (a squadron record) were sometimes flown in a day, casualties were few; and the diary shows almost more concern over the fact that a football match against No. 285 Squadron was lost by 6-nil.

Wing requirements were now 15 guaranteed sorties a night; but the squadron was able to do better than this, at least 16 being provided and, on two more occasions, 20. April showed, in fact, a splendid month's work by the squadron. With never more than 20 crews available, the total sorties rose to the record figure of 397.

It was a time of general congratulation for on May 1st the squadron flew its final sortie. V.E. day came a week later, and the interim was spent in celebration, formation-flying and runs to the coast for swimming.

Two days after V.E. day a move was made to Aviano where, apparently, some remarkably successful efforts were made to fraternize with the local inhabitants. Dances were held in the villages and the villagers were invited to visit the airfield and see the aircraft. Work consisted mostly in flying a mail service to Klagenfurt, in Austria, ferrying bombs from Forli to Aviano, and formation flying in practice for the Desert Air Force celebration fly-past, which took place on May 28th. The squadron supplied 12 Bostons, led by W/C. V. Rees.

The bottom now having dropped out of No. 18 Squadron's war, the greatest difficulty was found in keeping the men occupied. Various forms of sport proved a great help but, the diary records, "The excitement of football tends to become too much for the volatile Italian character."

A note of regret creeps in during August when, for the first time, it is recorded that the break-up of the squadron was imminent; members were beginning to be posted away. Only a little training flying was being done. Lack of occupation was, however, short-lived, for in the middle of September the squadron moved to Hassani in Greece, where much work had to be put in to render the living sites habitable. The only appreciated amenity available was the sea bathing. Marauding Greeks were the cause of considerable losses by theft, and billets had to be guarded continuously. At the new base, however, there was more flying, including practice formations, night flying, and air/sea rescue work with Lindholme gear.

But by the end of the year the unit was in poor shape. Depleted personnel-strength, bad living conditions, unfavourable rate of exchange, the lack of ordinary comforts and the continual necessity for guards against thieving; all these had their effect. With the exception of a few mail runs to Sedes, and the ferrying of six Bostons to Cairo, there was now very little flying.

At long last, after various postings and disposal of unwanted files, the squadron was disbanded on March 29th, 1946.

But as a unit No. 18 was not allowed to remain dormant for very long. With effect from September 1st, 1946, No. 621 Squadron, based at Ein Shemer in Palestine, was renumbered No. 18 G. R. Squadron, under the command of W/C. Peck, D.F.C. and later of S/L. Barden. The unit was equipped with

Lancasters and its main task was searching for ships attempting to land illegal immigrants.

The embodiment was very short-lived. One wonders why the change of number 621 to 18 was ever made, because at the end of just 14 days' existence No. 18 was again disbanded—or, rather, just faded away. The diary records no disbandment. In fact, on the *last two days of September* the change-over of command is noted, as is the fact that two aircraft arrived on detachment from No. 38 Squadron, stationed at Malta. The reason for this disparity in dates is that the official notification of disbandment dated September 15th apparently did not reach the unit until the end of the month.

No. 18 is next heard of in the Far East, using Mosquitoes for met. flights. There is, however, no day-to-day diary covering this period, and it may well be that in fact this was merely a "number-plate" re-forming.

There is no doubt about the next re-forming, which took place at Netheravon on December 8th, 1947, with eight Dakotas under the command of S/L. R. M. Burns. Within a week a move had been made to Waterbeach, and the Dakotas were being flown on services to the Continent and the Middle East. Oakington and Lyneham were used as Customs airfields.

In May 1948 the first internal shuttle services between Bückeburg and Berlin were flown and by July 7th Operation Plainfare, the airlift service to supply essentials to the Western Sector of Berlin, was in full swing, the unit operating between Wunsdorf, Fassberg, Lubeck and Gatow. Aircrews and groundcrews worked themselves to the limit.

After nearly three months' intensive flying on "Plainfare" the squadron flew back to England for a few days' stand-down, but they were soon back at Lubeck once more. After this, stand-downs became a more or less regular feature at six-week intervals.

Whenever a full day's operation of 20 sorties was completed it was reckoned that the squadron took slightly over 70 short tons of supplies into Berlin. The highest figure reached before the whole operation finished on August 26th, 1949, was 30 sorties on January 5th, when 105 short tons were flown in to the German capital.

Their sojourn in Germany over, No. 18 returned to Oakington and proceeded on 21 days' "Plainfare" leave. The squadron started "Plumber", and other operations and in October moved back to their old base at Waterbeach. Another disbandment came on February 20th, 1950, the last Dakota operation flown being a "Sunray" to Fayid in the Canal Zone by F/O. Gregory.

No. 18's next (and present) span of existence is much more exciting. On August 1st, 1953, the unit re-formed (under S/L. R. A. Cooper, M.B.E.) as a bomber squadron equipped with Canberras and based at Scampton. Within a fortnight it was operational, participating in Exercise Momentum with the only two Canberras then on charge. By the following month it was providing events for Battle of Britain Day flying displays, and competing for the Lawrence Minot bombing trophy.

As would be expected of a jet bomber squadron, much of No. 18's time now is devoted to practising with modern bomber techniques, the nature of which cannot, of course, be revealed. But there have been other jobs, such as flying to Gibraltar to collect newsreels and press photographs of the Royal visit to the Rock.

On July 5th, 1954, a squadron guest night was held and S/L. Cooper made every effort to get as many ex-commanding officers and members of the squadron as possible together. The gathering, which was thoroughly successful, included G/C. G. I. Carmichael, D.S.O., A.F.C., the first commanding officer; A.V.-M. Sir Ranald Reid, K.C.B., D.S.O., M.C.*; A.V-M. W. A. Opie, C.B.E., A.F.R.Ae.S.*; A. Cdre. G. S. Shaw, C.B.*; A. Cdre. H. E. Forrow, C.B., O.B.E.*; G/C. K. W. Niblett, D.F.C.*; W/C. G. C. O. Key, O.B.E., D.F.C.*; W/C. D. C. Sandeman, D.F.C.*; W/C. V. Rees, D.F.C.*; W/C. D. C. Smythe, D.S.O., G.M.*; S/L. G. Young; S/L. S. S. Dobbs; S/L. Rothwell; S/L. Le Gras; and F/L. C. F. J. Clampitt. It was indeed a grand reunion.

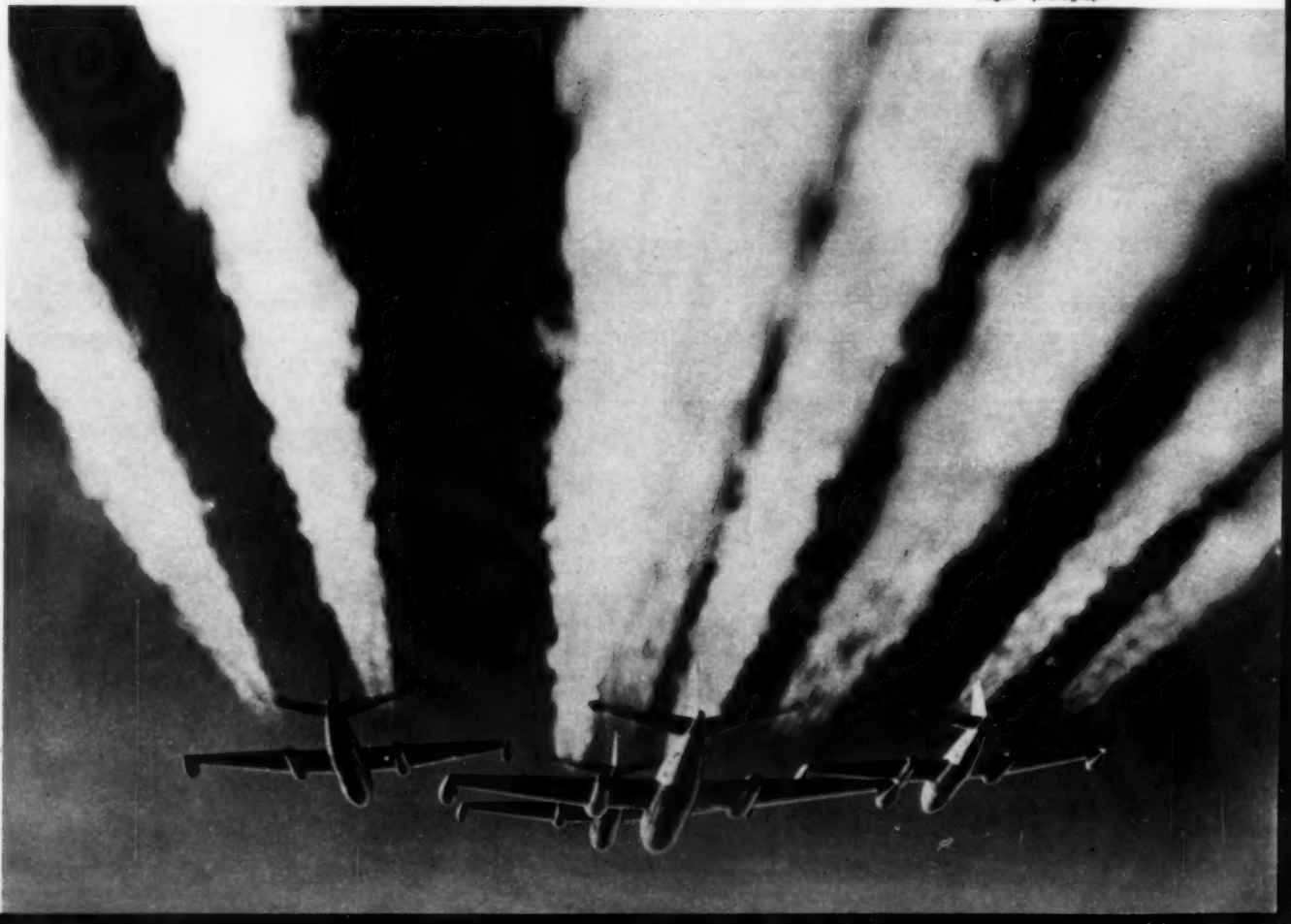
In November, 1954, came a change in command; W/C. R. A. Cooper was posted to H.Q. Bomber Command and S/L. A. H. Chamberlain, the present C.O., took over with effect from the 22nd. Last May the squadron moved from Scampton to Upwood, where it is now stationed. One of the pilots bears the honoured name of Verdon Roe; he is, in fact, a son of Sir Alliott Verdon Roe, the founder of the famous Avro concern.

No. 18 Squadron has had a long, if interrupted, career, serving with great honour through both World wars. Its future is impossible to predict, but a unit bearing such a famous number should at least be in a short list for re-equipping with one of the V-bomber types.

* *Ex-Commanding Officers.*

***With a very persistent contrail level at 30,000ft four pilots of No. 18 Squadron demonstrate their ability to fly a tidy box formation. Leading is S/L. Chamberlain with F/L. Abbott to port and F/O. Sherburn to starboard. In the box is F/O. Rickards.***

"Flight" photograph



*Idlewild's passenger buildings are temporary, but the 165ft control tower which overlooks them will survive as part of the permanent terminal.*

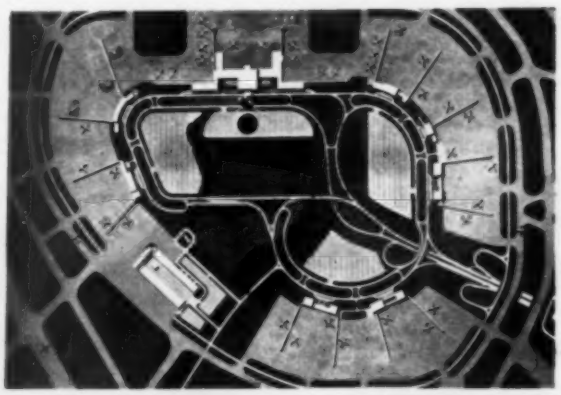
# IDLEWILD

## Today and Tomorrow

POPULARLY known as Idlewild, New York International Airport is one of four terminals operated by the Port of New York Authority; the others are La Guardia, Newark and Teterboro. Between them, the four airports handle more than 600,000 aircraft movements and some 10 million passengers annually.

In terms of traffic volume, La Guardia is the busiest of the four, dealing with more traffic in a year than all United Kingdom airports combined. As its name implies, however, New York International handles the bulk of overwater traffic, together with a considerable number of long-haul domestic services, and its total area of just over 5,000 acres is nine times that of La Guardia.

With its five active runways, ranging in length from 6,000 to 9,500ft, and its selection of large and expensive maintenance buildings, Idlewild is reasonably well equipped to meet most of



*Like the heading photograph, the second view (below) of the terminal area at New York International Airport was secured from a P.N.Y.A. helicopter. The artist's impression above shows the proposed layout of the permanent terminal, for more than 8m passengers annually.*

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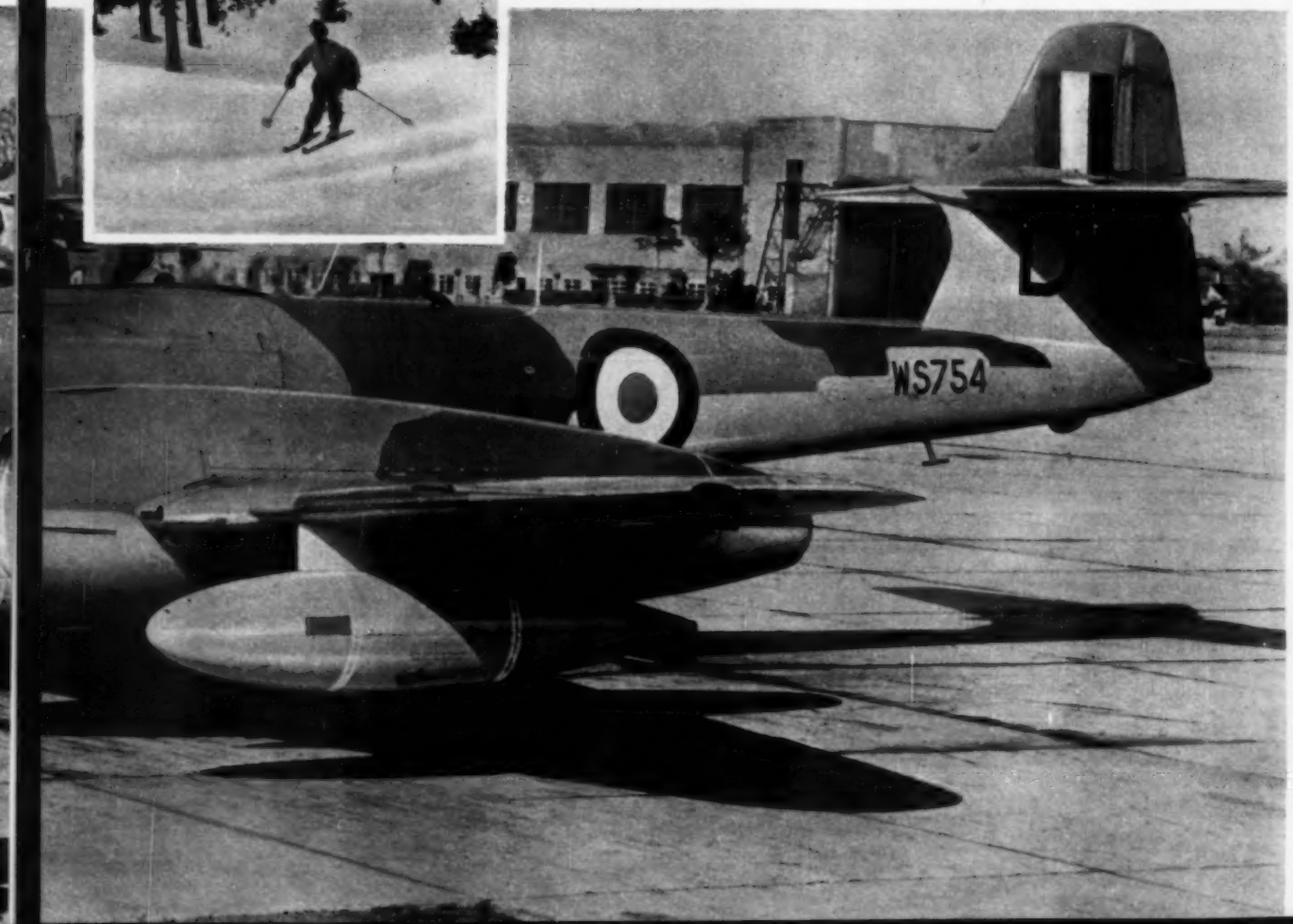
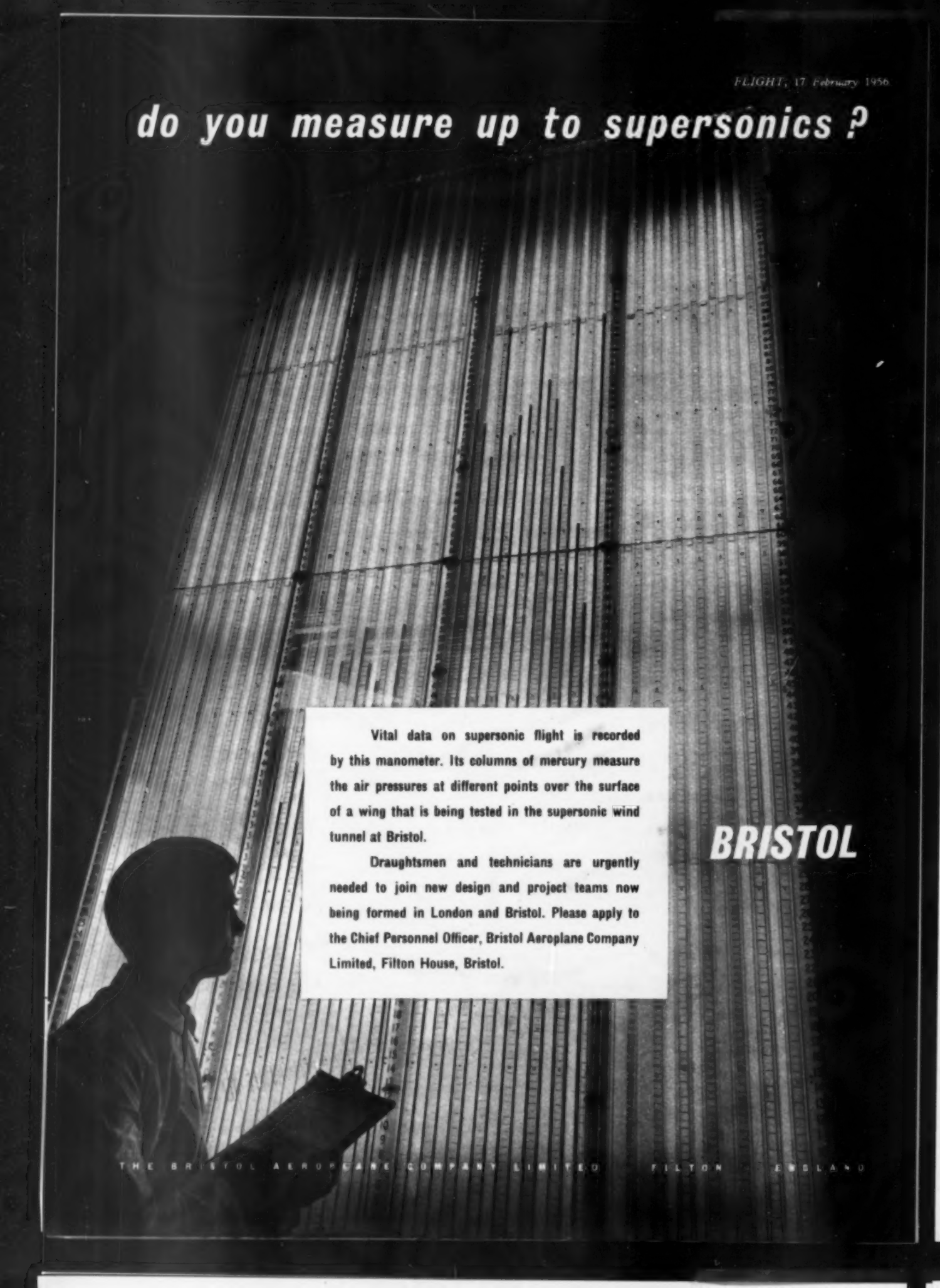
*You can now be granted a Direct Commission as pilot or navigator for a limited period or for service right up to pension age. There are further details of these two schemes and a full description of life in the R.A.F. in Air Ministry publications, that are yours for the asking. Your first step is to write for them, stating date of birth and educational qualifications, to the Air Ministry (F.R.30a), Adastral House, London, W.C.1. They are well worth reading.*

# The Royal Air Force

## *Flying ...and a career*



# do you measure up to supersonics ?



Vital data on supersonic flight is recorded by this manometer. Its columns of mercury measure the air pressures at different points over the surface of a wing that is being tested in the supersonic wind tunnel at Bristol.

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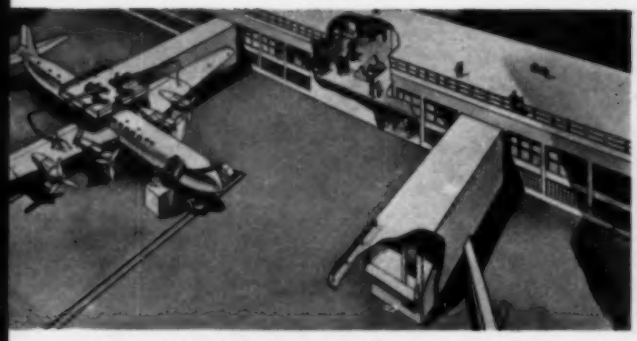


*A DC-7 of United Air Lines (right) is seen ready to take on passengers at the Whiting Loadair installed just over a year ago at Idlewild. The sketch suggests a method of incorporating Loadairs in a permanent terminal building; in developed form, the Loadair would include refuelling hoses, and the height of the dock could be varied to suit different types of aircraft.*

## IDLEWILD . . .

the purely mechanical needs of present-day traffic. The temporary passenger buildings, however, leave much to be desired, and travellers are looking forward to the opening of the new terminal facilities now in the initial stages of construction.

A unique feature of the New York International development plan is that it provides for the construction of passenger terminal buildings by individual operators as well as by the Port of New York Authority. The $15m international arrival building, due to be opened next year by the P.N.Y.A., is intended primarily for the use of overseas airlines. In addition, up to $30m (£10½m) will be spent on seven separate airline-operated terminals. Four companies—American, Eastern, PanAm and United—have already expressed the intention to build their own terminals at Idlewild.

When completed, the new terminal will be capable of handling 4m passengers annually, increasing to 8m by 1965, and there will be parking space for 140 aircraft. The 165ft control tower, incidentally, will be embodied as a permanent part of the rebuilt central terminal area.

The Whiting Loadair illustrated above has become a familiar part of the Idlewild scene over the past year. Consisting basically of a mechanical parking device and a covered walkway enabling passengers to embark or disembark without venturing into the open air, it was installed at New York on an experimental basis to enable the Port Authority and operators to assess in practice its many theoretical advantages. It is not yet known whether Loadairs will be included in the final development plan.

An aircraft using the Loadair places its wheels on dollies and, after stopping its engines, is moved sideways by an electric winch until its doors are flush with the entrance to the Loadair dock. The operation, during which the aircraft moves some 90ft in about one minute, is controlled by two push buttons (one at the dock and one on the ramp), and there are limit switches which automatically stop the aircraft at the proper point. Conversely, a departing aircraft is moved sideways away from the dock to the point which it starts its engines and taxies off the dollies.

In addition to the Whiting Loadair machinery, cars and trucks, the facility includes a dock building which is 94ft long and 10ft wide; the "air" end is two storeys high. The upper storey is used for boarding of passengers on the larger airliners and the lower for loading smaller aircraft and for baggage-handling.

# CORRESPONDENCE

*The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

### Veteran Constellations

IN your issue of January 27th Mr. Dennis Powell poses the question as to the number of hours flown with Air France by the veteran Lockheed 749, F-BAZR. Actual details are not available, but at the date of its last C. of A. inspection on May 18th, 1955, F-BAZR had done no fewer than 18,210 hours' flying. Perhaps if Mr. Powell knows the number of hours it flew in Mexican service, and cares to contact the Bureau Veritas in Paris, he could ascertain the required figure, but the flying hours at the various C. of A. renewals are not without interest:—

| | |
|---|---|
| July 15th, 1950 ... ... ... ... ... | 3,536 |
| June 15th, 1951 ... ... ... ... ... | 5,769 |
| August 21st, 1952 ... ... ... ... ... | 8,791 |
| September 12th, 1953 ... ... ... ... ... | 12,368 |
| August 19th, 1954 ... ... ... ... ... | 15,675 |
| May 18th, 1955 ... ... ... ... ... | 18,210 |

These figures are taken from the aeronautical register of the Bureau Veritas.

Desford, Leicester. DONALD A. S. MCKAY.

Thanks to *Flight* and Mr. Dennis Powell for the excellent photograph of that little-known Constellation XA-GOQ. Myself an aircraft historian, I can supply the details of hours flown for which Mr. Powell asks, also some further information.

Up to June 1955 it had flown a total of 18,210 hours. It was registered by Air France in March 1949, by which time it had flown 1,434 hours. As it was unlikely to have accumulated nearly 1,500 flying hours during its brief spell with Aerovias Guest, it can be assumed that it flew for a considerable while under its first civil registration, which was United States N86520.

London, S.E.5. L. T. MASON.

### The Felixstowe Boats

I SHOULD like to say a few words in reply to the letter from Mr. Lance R. Rudd which appeared on January 20th. It may well be that Mr. Rudd has exposed one of those myths which have a habit of establishing themselves in aeronautical history when he writes of the crash of the Felixstowe Fury and Maj. Moon's death. I felt I was on fairly safe ground in saying that Moon was killed in the Fury crash, because I found this passage in the April 1923 issue of *The Journal of the Royal Aeronautical Society*:—

"Several months before the accident Colonel Porte and myself [i.e., Major J. D. Rennie] were demobilized, there was therefore no technical officer in charge. No one knew where the c.g. ought to be or took the trouble to find out. The result was that the boat was loaded up with spares, etc., and the fuel, of which there was tankage of 1,500 gallons, most likely distributed in the tanks such that the final c.g. position was at least at .5 of the chord. Further, from a reliable and intelligent member of the crew, the late Major Moon attempted to take her off, as he had done on a previous occasion, before the minimum safe flying speed had been reached. As loaded, she was underpowered, there was therefore little available h.p. for acceleration, once clear of the water, with the inevitable result."

I also seem to recollect that the late Mr. C. G. Grey, in his book *Sea Flyers*, stated that Major Moon died in the Fury crash.

As for the performance figures, I can only repeat that those I quoted came from official performance reports, and represent actual speeds, times of climb and ceilings achieved at the weights quoted in each case.

Birmingham, 32. J. M. BRUCE.

### South Bank Helicopter Freight

TO assist future historians, who will already find it difficult enough to follow the slow progress of urban helicopter operations through the vicissitudes of Ministerial planning, may I point out that the first commercial air freight delivery to the South Bank Site was on June 21st, 1954, by an S. 51, G-AJOV, belonging to Autair, Ltd. A load of pressure cookers was delivered from Derby on this occasion.

This is with reference to the comment, in your issue for January 6th, on a recent landing at the South Bank.

Boxworth, Cambs. L. R. LORD.

### IN BRIEF

Mr. I. G. Campbell, 19, Malfin Drive, Belfast, who is seeking to record the inception and development of air traffic control in Great Britain, would be grateful for information, especially from those who were "aerodrome officers," on early ground assistance to aircraft, particularly in the 1919-1926 period.

# PROGRESS OF THE CLUBS

## *Points from the Ninth Annual A.B.A.C. Report*

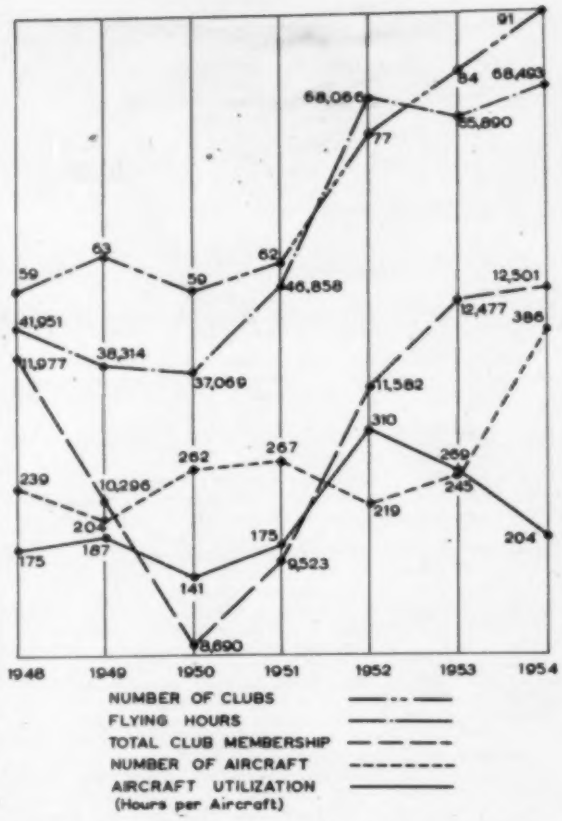
CURRENT membership of the Association of British Aero Clubs and Centres, as disclosed in the Report of the Council for the year ended June 30th last, stands at a record total of 97 clubs, centres and groups. During the year under review, there were in existence 91 clubs and the continued progress of the club movement had resulted in the highest totals of aircraft owned and hours flown since postwar club-flying began.

Commenting on the statistics (see graph) the report says "The utilization of aircraft is still too low, and clubs have the greatest difficulty in pegging their flying charges in the face of the general rise in costs; and, before the future of the club movement can be regarded as in any way secure, a considerable increase in flying hours—and in aircraft utilization—is necessary . . ."

The Government concession enabling club aircraft to land at certain designated State-owned aerodromes free of landing charges, the report continues, had been warmly welcomed by the clubs, "but the Council regret that no pleasure can be recorded at the manner in which the concession is being administered by the Ministry of Transport and Civil Aviation: that is by means of landing cards obtainable through the Royal Aero Club." The Association itself expected to supply such services on behalf of its member clubs, especially in connection with a concession that it had itself obtained for them. A further concession referred to in the report was the provision by Skyways, Ltd., of free landings at Lympne for club aircraft, on production of a landing card issued by the Association.

A total of 26 clubs had applied to participate in the A.T.C. air experience scheme, and 194 club pilots had been approved for such flying. The Firms' Flying Clubs scheme was progressing very slowly indeed.

The report goes on to disclose that the West London Aero Club had won the Lennox-Boyd Efficiency Trophy for 1954, with Exeter Aero Club second and Southend Air Centre and Flying School third.



*Two illustrations from the A.B.A.C. report: (above) annual statistics, 1948-54; (below, left) map showing location of U.K. member and associate-member clubs, 1956. Figures refer to the numbered list of clubs which is given as an appendix to the report.*

## NEW AIR RACE TROPHY

THE presentation of a new trophy, the Osram Cup, by the General Electric Co., Ltd., to the winner of one of this year's National Air Races, has been announced by the Royal Aero Club. The programme of races is based on a modified form of the 1955 arrangements, with two meetings in place of last year's four.

Four trophies are to be contested for the 1956 British Air Racing Championship. They are the S.B.A.C. Challenge Cup, the Osram Cup, the Kemsley Challenge Trophy and the Goodyear Air Trophy. First and second rounds of each of these races will be flown at Yeadon on May 21st; third rounds will be at Baginton on July 21st. The maximum take-off weight for competing aircraft will be 3,858 lb (1,750 kg) and, with the exception of the Goodyear race (which is for Tiger Moths), competitors will not enter for specific races, aircraft being allocated to races.

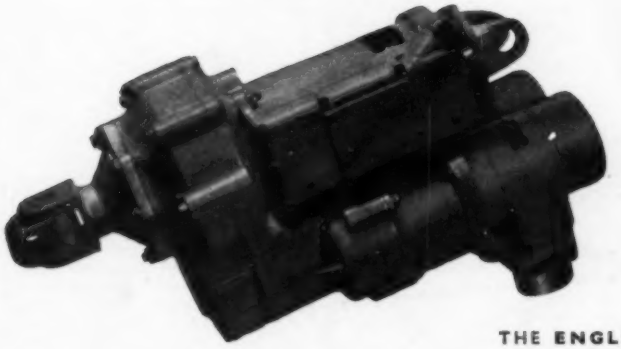
The pilot with most points in each race will become the winner of the appropriate trophy, and the British Air Racing Championship Trophy will go to the British pilot with the greatest aggregate number of points.

Competitors for the King's Cup Air Race, which is to take place at the Baginton meeting, will comprise the fifteen British pilots at the top of the championship table after completion of the three rounds. A new feature this year is that pilots finishing second, third and fourth in the King's Cup Race will receive the Air League Challenge Cup, Norton-Griffiths Challenge Trophy and Grosvenor Challenge Cup respectively.

Course distances and prize-money amounts are as follows: S.B.A.C. Cup and Osram Cup, four eight-mile laps; Kemsley and Goodyear Trophies, three eight-mile laps; prize-money per round of each race, first, £100; second, £50; third, £25. The King's Cup race will be flown over four 14-mile laps.

Eliminating trials for the British Lockheed International Aerobatic Trophy will be flown on July 20th at Baginton. Aerobatic performances will be of five minutes' duration, and the six pilots gaining most points will qualify for the final contest on July 21st. The prizes for this event are: first, £500; second, £300; third, £200; in addition, £100 will be awarded to the pilot gaining most points in each of two eliminating groups.

Entries for both race meetings should be received by the Royal Aero Club by April 16th (£5 entry fee per round); and for the aerobatic competition by June 4th, 1956 (£10 entry fee).



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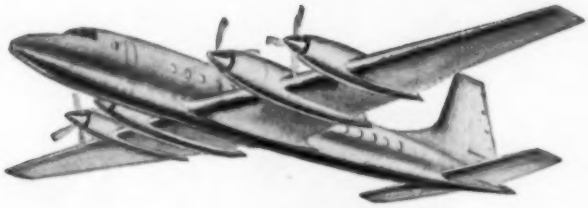

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# AS THE CROW FLIES

## *Aviation Units of Distance and Speed: Their Implications and Current Usage*

By L. F. E. COOMBS

MAN has always been able to agree that a system was imperfect. Unfortunately he has not always agreed on how the imperfect should be made perfect. The division of the earth's surface into units of distance was originally based upon units which, although having a definite relationship to familiar things such as the width of a man's hand, did not have any relationship with the earth as a whole. When the time came to rationalize and legalize units of distance each nation developed a system based upon its past experiences, and in only a few cases could the system be related with the size of the earth. The most notable example was the metric system, but, as will be seen, its originators made an error in their calculations.

Organizations that attempt to standardize or rationalize units of measurement are confronted with a formidable task when they come to consider the aviation unit of distance. During the course of their investigations they will be faced with the following values, in feet, for the units of distance used by the practical and the theoretical sections of aviation:—

The nautical mile, based on a minute of latitude, with a value varying between the limits of 6,046 and 6,108.
The Admiralty standard nautical mile of 6,080 and the U.S. standard n.m. of 6,080.2.
The geographical mile of 6,087.2 and the international n.m. of 6,076.1.
The radar mile of 6,000 and the English statute mile of 5,280.
Not forgetting, of course, the kilometre of 3,280ft.

The major protagonists of the various units of distance, nautical mile, statute mile and kilometre, appear to have arranged themselves into a triangle of opposition, each side assuring the other two that its arguments must indicate that it is the hypotenuse and, therefore, that the other contending sides are of less importance.

One of the opponents, without doubt, is the metric system, which has the whole-hearted backing of the scientific world and of an aeronautical journal which strongly advocates its international adoption for aviation. However, despite the advantages of its "internationalism" the kilometre has not been used to the extent that might have been expected.

The kilometre was legally defined for the first time in 1799 when it was given as 1/40,000th of the earth's circumference. Unfortunately the scientists of the First Republic of France made some mistakes in their calculations, in particular in relation to the shape of the earth, thereby divorcing the kilometre from its possible use in conjunction with the measurement of angles by grades. The kilometre, if it was accurately 1/40,000th of the circumference, would have had a useful relationship with the angular division of Great Circles into 400 grades. One grade would then have been subtended by 100 kilometres. It can be argued that for all practicable purposes the slight error involved can be ignored. That is true, but when establishing any system the basis must be as accurate as possible otherwise it is open to abuse. In this case the error would reach unacceptable proportions over long distances.

The practicability of any unit of distance must depend on, among other things, the facility with which it can be manipulated and also, to a greater extent, on its compatability with allied units of measurement. The metric system has a large measure of suitability for facile manipulation. Its major drawback for practical aviation use, like the English statute mile, is in long-range navigation and astro-navigation, which are based on circles of 360 degrees sub-divided into minutes, or nautical miles. Even the major supporter of the metric system, the scientist, departs from the strict decimal divisions for his c.g.s. system by using a sexagesimal division of time.

The second contender of the triangle is the English statute mile of 5,280ft, referred to by a critic as "the motor-car mile." The supporters of the statute mile keep one foot firmly planted on the platform of "why change things?" and the other in history. Unlike the nautical mile and the kilometre, the statute mile cannot even claim a rough connection with the size of the earth. It was first legally defined by a decree of Queen Elizabeth I as a distance of eight furlongs. Even after that time the British Isles suffered a variety of values for the land mile. Naturally, both the Scots and the Irish had their own values for their land miles. The mile first came into use as a means of dividing up the distance between the league, about 18,000ft, and the Greek *stadia*, about 600ft. As with those distances the mile assumed varying values dependent on the country of use. England came under the influence of the Roman *mille*, or mile, of 1,000 paces, each pace being just under 5ft.

Until the Second World War the statute mile and m.p.h. were the accepted units of distance and speed for aviation in the English-speaking countries. Flying had started in fields, progressed to adjacent fields a few furlongs away and then, as machines improved and distance became important, railways and roads, both measured by statute miles, became the first air routes. The early aviators, apart from Blériot, contented themselves with flying over land and did not normally venture (if it could be helped) over water. Therefore, the existing land maps were satisfactory for all speed and distance calculations.

From about 1930 onwards, the increasing number of long-distance flights, particularly those across oceans, began to call for a more workable unit of distance than the statute mile. The years just before the war saw the introduction of flying-boat passenger services and the ever-increasing use of the marine chart and astro-navigation, thereby encouraging the use of the nautical mile. The most extensive use of the nautical mile and the knot was to be found in U.S. Naval Aviation and in some R.A.F. squadrons, particularly those of the old Fleet Air Arm.

During the war the R.A.F. began to adopt the nautical mile for certain commands and types of aircraft, as did the U.S.A.A.F., who operated B-29s on very long over-water flights. That tendency was encouraged by the introduction of such navigational aids as the air-mileage unit and the air-position indicator. As the war drew to a close the R.A.F. began to use the nautical mile as the preferred unit of distance. This was a logical step, as aircraft operations (other than tactical support flying) had by then become divorced further and further from the ground and its features distanced by the strides of Roman legions.

At about the same time I.C.A.O., after much discussion, adopted the nautical mile and the knot as the preferred units of distance and speed for its tables of dimensions. However, it must not be thought that such a decision reflected an overwhelming majority in favour of the nautical mile. The decision was reached only after a majority of members had expressed their preference for the metric system, but would not impose it for the unit of distance owing to the complications it might bring to air navigation, as distinct from other aviation uses.

Although a member of I.C.A.O., and the largest in terms of numbers of aircraft, the U.S. civil operators stuck to their Elizabethan statute miles along with the use of "gotten." But they eventually had to give ground and were instructed by the C.A.B. to use the nautical mile and knot after October 1st, 1953. It could be reasoned that such a change was the outcome of representations from the U.S.A.F., who argued that the country's military requirements must outweigh any objections that the civil operators might have.

On this side of the Iron Curtain the majority of airspeed indicators are now calibrated in knots. Even the revived Deutsch Lufthansa complies with the I.C.A.O. preferred table of dimensions and ignores the once-used metric system.

Despite the apparently overwhelming use of the nautical mile by I.C.A.O. members and NATO, it is still a unit which cannot stand too much scrutiny. To start with, the two bodies who were the first to establish it as a specific distance, the Admiralty and the U.S. Geodetic Service, gave differing values. The Admiralty defined the nautical mile as one of 6,080ft whereas the United States defined it as 6,080.22ft. To increase the confusion, the International Hydrographic Bureau said 6,076.12ft.

For all practical purposes, of course, the navigator uses the minutes of latitude on his chart and calls them miles. By so doing he introduces an error in distance, of three miles in every 600, which is overshadowed by the accepted errors of navigation. It is possible that increasing speeds and distances will make even the nautical mile unacceptable for correct positioning. Although the nautical mile, as distinct from the land mile, can be said to date from only 1637, its origin is further back in history; before that time the league was the usual marine distance.

Ignoring the earliest measurements—such as the width of a man's hand or the length from knuckle to thumb-tip—the start of our present-day mile of 6,080ft was most likely the Greek Olympic stadium. That at Attica was 608ft in length, which (with its sub-division, the fathom of 6ft) made an approximate decimal system of length. The mile, both sea and land, did not appear until much later. As already mentioned, it was introduced

## AS THE CROW FLIES . . .

primarily to divide up the comparatively large gap between the stadia and the league. So followed the Mediterranean mile of 4,035.43ft, the Roman mile of 4,858.6ft (1,000 paces) and the Arabian mile of 6,000 Arabian ft. As can be seen, none of those units had any deliberate relationship with the size of the earth, which in any case was assumed to be flat—and, no doubt, cartographers and navigators liked it that way.

The first recorded attempt to relate the unit of distance with the earth was by Eratosthanes of Alexandria, who determined that each degree would subtend 70 sea miles or 700 *stadia*. As the great voyages of discovery successfully introduced more accurate estimations of the size of the earth, the Great Circle distance of one degree settled down conveniently at 60 sea miles. Thereafter the mariner took his mile as one minute of arc anywhere on the surface of the earth.

The popularity of the nautical mile for air and sea navigation is, therefore, primarily due to the fact that it is based on an angle of one minute at the centre of curvature. Unfortunately for navigators and others, the earth is not a perfect sphere and, therefore, the length of a Great Circle arc of one minute is by no means constant. The flattening of the earth at the poles has the effect of increasing the distance on the earth's surface from a minute of 6,046ft at the equator to a minute of 6,108ft at the poles. Although the distorted sphere of the earth, the oblate-spheroid, prevented a constant value for the sea mile, the standard nautical mile of 6,080ft was evolved by the Admiralty. General usage has dropped the "standard" and it is safe to assume that when the nautical mile is referred to it is one of 6,080ft. The equator (forming, as it does, a circle) has, therefore, equal distances subtending equal angles at the earth's centre. The circumference is 21,600 minutes of arc, each of 6,087.2ft, and referred to as geographical miles.

One result of the slow and somewhat confused evolution of the kilometre, the nautical mile and the statute mile is the variety of measurements available to aviation writers. Many delight in it and use all three units within the same article. Fortunately, those writing of sea and land transport are content to keep to the same unit of distance or speed throughout, thereby simplifying the reader's task.

Despite the claims of the knot and the kilometre there is a lot to be said for the principle of using the units of measurement understood best by the general reader. In Great Britain, obviously, the statute mile and m.p.h. are best understood. Four hundred m.p.h. is readily visualized by the layman, depending on his interests; for example—"London to Edinburgh in one hour, or ten times the top speed of his 1927 model." Similarly with distance.

In the United States, where the statute mile and m.p.h. were used, with few exceptions, in both the lay and the technical Press, the knot is now appearing more often in both technical and non-technical articles. Even articles dealing with the economics of aviation and aerodynamics tend to incorporate the knot, which is contrary to the general practice of British writers on those subjects.

It is interesting to observe that writers of articles which deal with the performance of aircraft tend to give actual observed, or defined, airspeeds in knots and precise distances in nautical miles; but, in contrast, when referring to approximate speeds and distances, use m.p.h. and miles. This is also the case in general conversation. It is unusual to hear, except from aircrew, "must be doing about 600 knots." You will most likely hear "about 600 m.p.h." Digressing for a moment: "about 600 m.p.h." seems to be applied to any speed between 500 and 700 m.p.h.

The daily Press has an interesting approach to the units of distance and speed. It assumes that the general public can assimilate the meaning of "The Queen Mary averaged 30 knots for 1,000 [sea?] miles" but does not assume that "the aircraft was delayed by a head-wind of 30 knots" would be understood by its readers.

# THE INDUSTRY

### Napier Apprentice Progress

SPEAKING at the annual prize presentation to apprentices of D. Napier and Son, Ltd., Viscount Caldecote, D.S.C., A.M.I.Mech.E., A.M.I.N.A., N.E.C.Inst., a director of the English Electric Co., Ltd., referred to "tradition," saying that the Napier company originated at the beginning of the nineteenth century and was the oldest member of the English Electric Group. "But tradition," he added, "means that you are building on past success, not that you are a stick-in-the-mud, unable to move out of past ways."

Mr. H. Sammons, C.B.E., M.I.Mech.E., F.R.Ae.S., F.R.S.A., Napier managing director, spoke of the management's aim further to increase and improve the training programme, and went on to express the gratitude of the Board to the 27 technical colleges and polytechnics who were supporting the scheme; to the Napier foremen; and to Mr. J. F. A. Radford (chief of personnel and training) and his staff.

In his report, Mr. Radford said that of the 13 apprentices who entered for the various stages of the B.Sc. engineering examination, all had passed; 19 had entered for Higher National Diploma courses in production and mechanical engineering, and only one had failed; and 76 had passed their examinations in the various years of the Ordinary National Certificate, 15 in the Higher National Certificate and 75 in the City and Guilds courses. There were now 206 ex-apprentices employed in the London group of Napier factories, and the company hoped to double that number by 1958. Recipients of prizes and certificates, which were presented by various officials of the company, included the following:—C. E. Blamey, A. R. Elsdon, A. Stone, A. H. Speck, R. Plowman, J. F. Price, P. S. Browning, S. A. Gauci, R. G. Seaman, R. Devereux, and B. V. George.

*Mr. H. Sammons presents the Napier trophy to R. W. Plowman.*

### Research Company Formed

ANOTHER new company, to be known as Plessey Research, Ltd., has been formed within the Plessey Group.

During recent years research establishments have been founded by the Group in various parts of the country, working on projects ranging from basic research to component-development and application research of various types. Some of these concern secret Government projects, but a high proportion are devoted to commercial development. A point has now been reached, state Plessey, where the Board has decided to unify and bring together the control of all these units in order to achieve the maximum long-term results.

The directors of the new company are Mr. A. G. Clark (chairman and managing director), and Messrs. B. G. W. Attwood, E. J. Earnshaw, M. Clark and G. C. Gaut.

# IN BRIEF

Mr. S. M. F. Allfrey has been appointed administrative manager of the tyre sales division at Fort Dunlop, and now takes over the duties of Mr. Alfred Rose, operating manager, who has retired after nearly 49 years' service.

* * *

During 1955 over 60,000 showings were made of films borrowed from the Petroleum Films Bureau. Over 20 aviation documentaries are among the stock available for loan to organizations of various kinds. The P.F.B.'s offices are at 29 New Bond Street, London, W.1.

* * *

W/C. P. G. Monk, technical sales manager of the aviation division of Elliott Bros. (London), Ltd., is at present visiting America in connection with the R.A.E./Elliott automatic pilot for target aircraft. The sale of Jindivik targets to the United States by the Australian Government says the company, has opened a new market for the type of equipment. W/C. Monk is due to return to London shortly before the end of the month; meanwhile he may be contacted c/o. Mr. C. Wolf, Eclipse-Pioneer Division, Bendix Aviation Corporation, Teterboro, New Jersey.

# WINGS OF NATO

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Freedom-loving people everywhere can be proud of all the Wings of NATO—proud, too, of the armies and navies—protecting the best aspirations of men as they work for the peace of the world.

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# CIVIL AVIATION

## THE BRITANNIA'S SUCCESSOR

THE statement issued last week by Bristol and the U.S. General Dynamics Corporation concerning the joint development of a 500 m.p.h., 130-passenger BE.25-powered airliner was necessarily guarded, as might be expected at such an early stage in the negotiations. However, one point clearly emerges, and this is that Bristol will "go it alone" until agreement has been reached as to its financing and the spreading of development and production effort in the United Kingdom. There is no immediate likelihood of a technical tie-up between Bristol and Convair, although discussions continue with Canadair, who are building a military derivative of the Britannia for the R.C.A.F., about the manufacture of the civil Britannia.

## QUADRUPLE SCOTCH?

A SUCCESSOR to the Scottish Aviation Twin Pioneer is reported to have reached the design stage. Intended for production in about five years' time, it will be powered by turboprops of unspecified type. Though retaining the Twin Pioneer's 100 yd ground-run, it will be a larger, faster machine, capable of carrying 40 passengers or 10,000 lb of cargo. Such a machine would seem assured of a wide market; in fact, it is curious that the only existing project is the American Frye F.1.

## AIR TRANSPORT COURSE

A COURSE of lectures on air transport, to be given at Christ Church College, Oxford, from April 4th to 18th has been organized by the Royal Aeronautical Society. Air transport economics, air transport operation, and air law will form the three main subjects, and additional lectures on specialized subjects will be given by guest lecturers.

The resident lecturers will be Mr. S. F. Wheatcroft, B.Sc. (Econ.), economics; Mr. K. G. Wilkinson, B.Sc., operation; and Mr. A. R. Barrowclough, B.A., air law. It is hoped that guest lecturers will include Mr. P. G. Masefield, M. Henri Bouche, Prof. John C. Cooper, Prof. G. D. Goedhuis, Mr. Bo Bjorkman, Sir William Hildred, Mr. Garret Fitzgerald, Dr. Ing. Publio Magini, and Prof. E. J. Richards.

The course is intended for junior executives aged 25-35, and has been "framed to emphasize the international nature of the air-transport industry." Registration, tuition and residence fees total £84; further information and application forms are obtainable from the director of the course, Dr. A. M. Ballantyne, The Royal Aeronautical Society, 4 Hamilton Place, London, W.1.

## COMET TANK-TEST

WATER-tank testing of a D.H. Comet 2 of the type ordered for Transport Command was interrupted recently by the failure of a wing component after 15,000 hr of simulated flight. It was emphasized by the manufacturers that there had been no failure of the pressure cabin, and that the incident would not cause any delay in the delivery of the 12 Comet 2s ordered by the Ministry of Supply for Transport Command; the wing had, in fact, safely completed the number of hours called for in the contract. No further details were given of the component failure; full conclusions could not be drawn until the end of the tests.

## WANTED: MORE CONCRETE

SOME sober thoughts on the implication of recent jet transport orders have been expressed by *American Aviation Daily* in an article discussing the runway requirements of the new Boeing and Douglas airliners. It quotes an American airline president as saying: "We are buying airplanes that haven't yet been fully designed with millions of dollars we don't have and are going to operate them off airports that are too small, in an air traffic control system that is too slow, and we must fill them with more passengers than we have ever carried before;" and the *Daily* notes that: "This philosophizing . . . is perhaps a little too pessimistic but it does highlight the tremendous problems airline management is shouldering with its entry into the jet era."

The publication reports that the current gross weight for the DC-8 now stands at 275,000 lb and that some versions of the Boeing 707 may exceed 300,000 lb. To enable these aircraft to operate with full tanks and full payloads an all-round strengthening and lengthening of runways would be required. The safe minimum for the DC-8, it was believed, would be in the region of 9,500ft. At Denver, with its high temperatures and high altitude, a runway of no less than 15,000ft would be necessary. The cost of extending a runway strong enough to take the new jet transports is quoted by the S.B.A.C. as approximately £10,000 for each 100ft of a surface 450ft wide.

## AMERICAN FRIENDSHIPS

ORDERS have been placed, it is reported, by seven American airlines for a total of 30 Fokker Friendships, with options on a further 10. The report, not yet confirmed by the Dutch manufacturer, adds that the aircraft will be built under licence by Fairchild. The first United States operator to have announced a definite order for Friendships is Mackey Airlines, of Florida. Scheduled delivery dates for the two aircraft ordered by Mackey are October 1st and November 1st next year.

## BOEINGS FOR T.W.A.

A "PRELIMINARY" order for jet transports—eight Boeing 707 Stratoliners—was announced on February 7th on behalf of Trans World Airlines. The news was given by Mr. Howard Hughes, head of the Hughes Tool Company, which will actually buy the aircraft and make them available to T.W.A.

Mr. Hughes described the order as "the first step" in providing T.W.A. with jet transports, adding that 22 more jet aircraft would be ordered for T.W.A. during the next few months. Discussions were continuing with Boeing on the subject of the additional aircraft.

The eight Boeing 707s ordered so far will cost approximately £1,600,000 each and will be delivered over the period April-August 1959. The announcement did not state specifically which of the three versions of the 707 had been bought, but went on to refer to the ability of the 707-120 to fly from New York to London in 5 hr 55 min and from Los Angeles to New York in 4 hr 15 min.

This reference, associated with the early delivery date, indicates that the initial order must be for the J57-powered model 120. This version was not developed for transatlantic service and it is probable that the eight aircraft ordered by T.W.A. are destined for service on transcontinental routes. Their purchase by T.W.A. was virtually forced on the company by pressure of competition from the other leading domestic airlines, all of whom had already placed their orders for Boeing or Douglas jets.

## BRITANNIA NEWS

DETAILS of B.O.A.C.'s plans for introducing Britannias this year on the commonwealth routes were given last week in Perth (W. Australia) by Lord Rennell, the deputy chairman. The aircraft would enter service in July on the South African route and their appearance on the Kangaroo route between London and Sydney was scheduled for September. Britannia services would be extended to other far eastern points early next year.

Training of B.O.A.C. Britannia crews at Hurn, which began last month (soon after the delivery of the Corporation's first two certificated Britannia 100s) has been temporarily suspended. The reason for the suspension was given on February 4th as "stiffening of controls at low temperatures." The manufacturers are conducting experiments to discover and eliminate the cause of the trouble.

It is now possible to add more information to the paragraph on Britannia flight-crew requirements published in *Flight* for February 3rd. It should be noted that the Britannia's flight deck is laid out for a minimum crew of two, and that during flight testing trials were undertaken to demonstrate that two pilots could deal with any emergency without having to release their seat straps. However, it was decided that initially, and until more route experience had been gained, the aircraft should be flown with a minimum crew of three of whom two must be pilots and a third must hold a flight engineer's licence. In many instances it is more convenient that this third crew member should be a pilot having flight engineer's qualifications, and in order to meet this requirement, Bristol service schools are extending their courses to enable pilots to gain this licence. It is hoped that B.O.A.C.'s experience with the Britannia 100 will enable approval to be given for operation by two pilots only.

## HUNTING ANGLO-CANADIAN LIAISON

A RECENT visitor to this country was Mr. Douglas N. Kendall, founder of the Canadian Hunting companies almost ten years ago and now vice-president of Hunting Associates, Ltd., of Toronto. The object of his visit was liaison with the U.K. Hunting companies in connection with the planning of the group's future activities. Also in England on liaison work was Mr. J. B. McCluskey, a geological engineer of Aeromagnetic Surveys, Ltd., who during his stay addressed a meeting of British scientists on the use of survey equipment which his company had developed.

The five main companies in the Canadian Hunting Associates Group are the Photographic Survey Corporation, P.S.C. Applied Research, Ltd., Aeromagnetic Surveys, Ltd., Kenting Aviation

## CIVIL AVIATION . . .

and Field Aviation. Aeromagnetic Surveys pioneered the use of the airborne electromagnetometer, and are now co-operating with Hunting Geophysics in the U.K., who are also to adopt this device. A first step is the triple installation of magnetometer, electromagnetometer and scintillation counter in a Dakota belonging to the U.K. group.

# BREVITIES

THE three DC-6As which Airwork had on order for their Atlantic service have, it is reported, been bought by Slick Airways, Inc. Suspension of the service was announced in December, when it was stated that the DC-6As had been sold ahead of delivery. The three Viscounts ordered by the company for delivery this year were also sold recently, to Compania Cubana de Aviacion.

* * *

The overhaul life of de Havilland airscrews fitted to the Hercules-powered Bristol 170 Mks 31 and 32 has been extended by 200 hr to 1,600hr.

* * *

Mr. J. van der Wiel, general secretary of K.L.M. since 1947, has been appointed executive vice-president. After the war Mr. van der Wiel was largely responsible, under Dr. Plesman, for rebuilding the organization of the Dutch airline.

* * *

Believed to be one of the oldest active airline pilots, Cdr. L. Inggs of South African Airways will retire next September on reaching the age of 60. He began his flying career with the R.F.C. and now has some 23,000 hours to his credit.

* * *

Shannon Airport handled 9,923 aircraft movements last year, compared with 7,169 in 1954; of last year's total 2,758 movements were by PanAm aircraft. The record month was August, when 1,061 aircraft landed or took off from Shannon.

* * *

The Singapore General Employees' Union is said to have put forward a claim for what it terms the "Malayanization" of Malayan Airways. The airline is alleged by the union to have pursued a policy of discrimination against Malayan personnel.

* * *

T.C.A.'s director of engineering, Mr. J. T. Dyment, has been elected by the Society of Automotive Engineers as vice-president in charge of activities concerned with air transport for 1956. He will be the first Canadian to lead the S.A.E. Air Transport Committee, which has a membership of 39.

* * *

T.W.A. celebrated completion of ten years of international air services on February 5th. Since the company inaugurated international operations (on the route between New York and Paris) in 1946, its aircraft have made 25,300 transatlantic crossings, carrying a total of 1,388,000 passengers.

*The East German Lufthansa—not to be confused with their Western counterpart—began regular services on February 4th on the Berlin-Warsaw route, which is operated twice weekly. The inaugural aircraft, shown below at Schonefeld, was an Il-12 supplied by Aeroflot and bearing the Soviet airline's emblem.*

*"Period 16" of the Boeing 707 development programme, due to begin last week, involves subjecting the prototype to 80 per cent of design load. These trials were preceded by a "lay-up period," during which 72 strain gauges were installed in the wing and calibrated in the massive test rig illustrated above. A 33 per cent load was applied, resulting in a wing tip deflection of 49in.*

The Australian Government is reported to be considering a ban on the sale of alcohol aboard airliners. A report on the subject has been prepared by the Civil Aviation Department which is said to be concerned about two recent "brawls" involving drunken passengers.

* * *

A bilateral air agreement between the Republic of Ireland and the Federal German Republic was signed in Bonn on February 1st. The agreement provides Lufthansa and Aer Lingus with reciprocal operating rights between the two countries; it also permits the German airline to operate through Shannon to points beyond, and gives Aer Lingus fifth-freedom rights in Germany.

### FORTHCOMING EVENTS

Feb. 17. Air Transport Auxiliary Association: Annual Dinner, Eccleston Hotel.
Feb. 17. Association of British Aero Clubs and Centres: Annual Dinner.
Feb. 18. Yorkshire Aeroplane Club: Formal Dinner Dance.
Feb. 21. R.Ae.S.: Section Lecture: "Design of Low Landing Speed Aircraft," by R. C. McIntyre, A.F.R.Ae.S.
Feb. 22. Kronfeld Club: Film Show.
Feb. 23. Aerodrome Owners Association: Annual General Meeting, and Annual Dinner.
Feb. 24. Lancashire Aero Club: Annual Supper Dance.
Feb. 28. R.Ae.S.: Section Lecture: "Use of Elementary Plasticity in Design," by A. J. Barrett, B.Sc.(Eng.), M.S. in A.E., M.I.A.S., A.F.R.Ae.S.
Feb. 29. Kronfeld Club: "Cumulus Clouds", by Dr. Scorer.
Mar. 1. R.Ae.S.: Section Lecture: "Powerplants for Supersonic Flight," by Dr. E. S. Moult, B.Sc., M.I.Mech.E., F.R.Ae.S.
Mar. 6. R.Ae.S.: Graduates and Students Section: Annual General Meeting and Film Show.
Mar. 7. R.Ae.S.: Ninth Louis Bleriot Lecture, in Paris: "Organization of Aeronautical Research", by E.T. Jones, C.B., O.B.E., M.Eng. F.R.Ae.S.
Mar. 7. British Interplanetary Society: "Combustion Chambers for Rocket Engines", by Prof. A.D. Baxter, M.Eng., M.I.Mech.E., F.R.Ae.S., F.Inst.P.

**R.Ae.S. Branch Fixtures (to March 8th).**

Feb. 21, *Belfast*, "The New London Airport," by R. F. Bulstrode. Feb. 22, *Weybridge*, "Training and Research in the Field of Aircraft Production," by Prof. J. V. Connolly. Feb 23. *Cheltenham*, "The Investigation of Flutter by Flight Tests," by H. G. Peacock. Feb. 24, *Leicester*, Lecture.

Mar. 6, *Belfast*, "Aircraft and Shipyard Lofting", by A.C. Patrick; *Boscombe Down*, Film or Discussion; *Bristol*, Third Barnwell Memorial Lecture: "Achievements and Prospects in the Field of Aircraft Engines", by A.C. Lovesey. Mar. 8, *Isle of Wight*, "Fatigue of Metals", by Maj. F.L. Teed.

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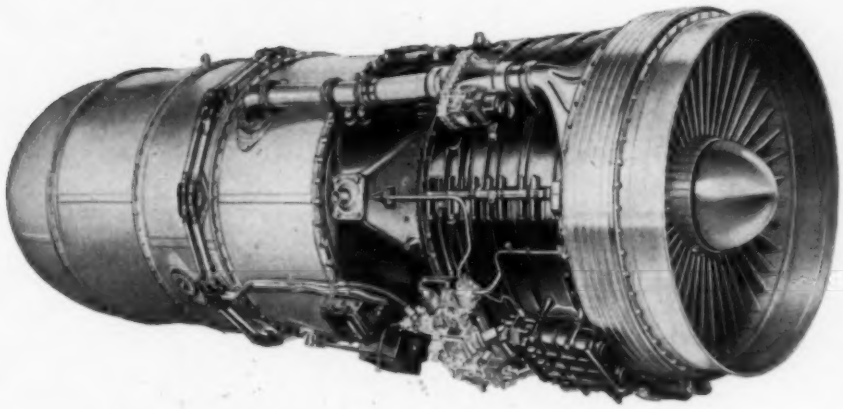

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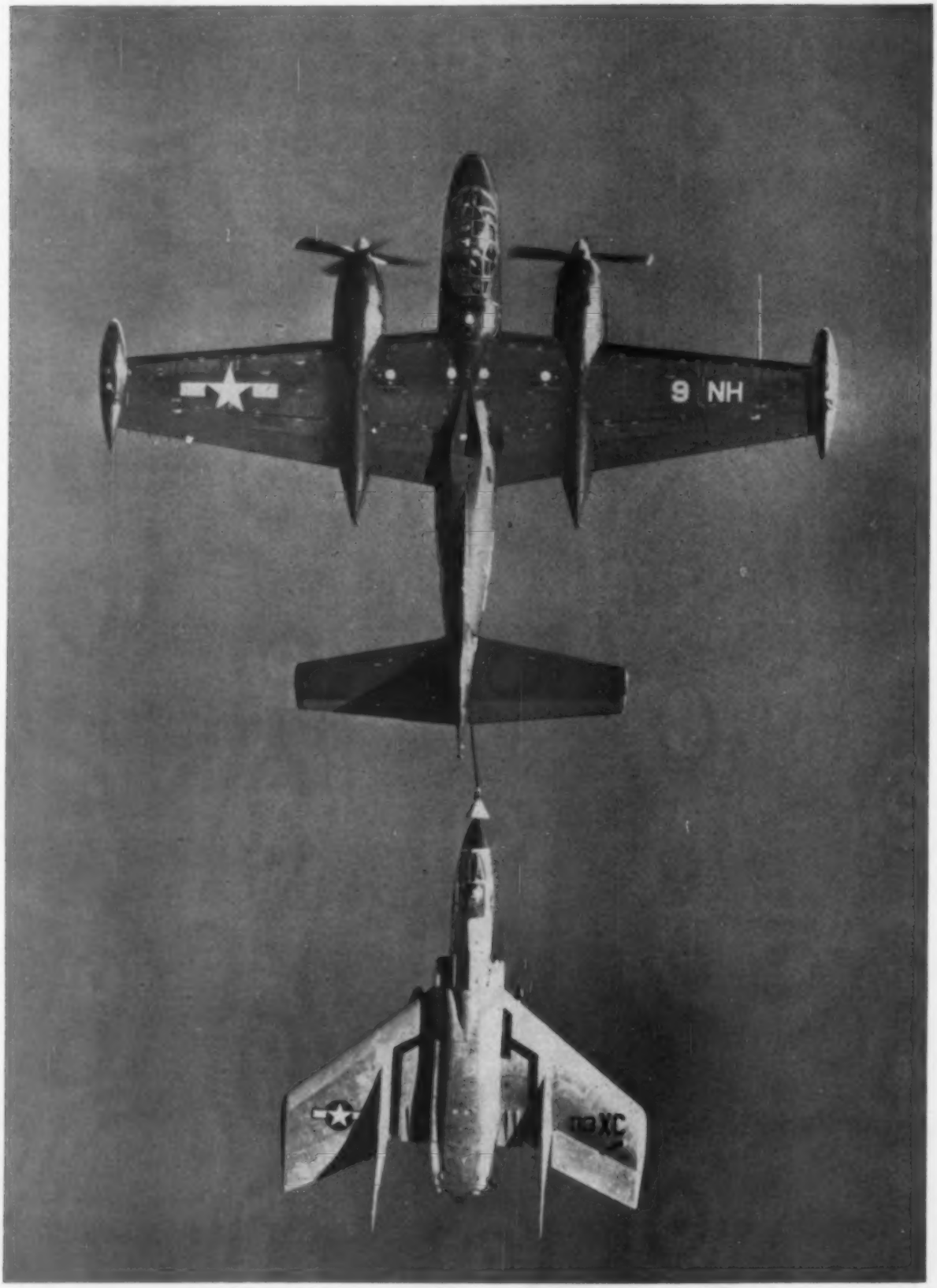


Chance Vought F7U being refuelled in flight by probe & drogue method from North American AJ tanker. Refuelling system manufactured by Flight Refueling Inc. U.S.A.

# U.S. Navy equips entire fighter fleet with Probe and Drogue

*The United States Navy has now revealed that 'all new Navy fighters now in production are being fitted with gear which enables them to be refueled in flight', an undisclosed number of carrier squadrons being already thus equipped.*

'Establishment of in-flight refueling by the Navy as a routine operational procedure comes after years of perfection and development of refueling techniques. The system now standardised is the Probe and Drogue . . .

'Through its use, jets can be launched with a maximum bomb and armament load . . . a fighter's range can be more than doubled . . . fighters flying protective cover around a given area can be kept aloft virtually indefinitely . . . carriers can launch their attacks much further away from the enemy and thus greatly reduce the possibility of early detection . . .'

*Extracts from announcement by U.S. Dept. of Defense.*

**F-R Probe and Drogue flight refuelling equipment is also specified by the U.S. Air Force, the Royal Navy and the Royal Air Force.**

Flight deck of U.S.S. Hancock showing Chance Vought F7U's fitted for probe and drogue in-flight refuelling as originated in England by Flight Refuelling Ltd.

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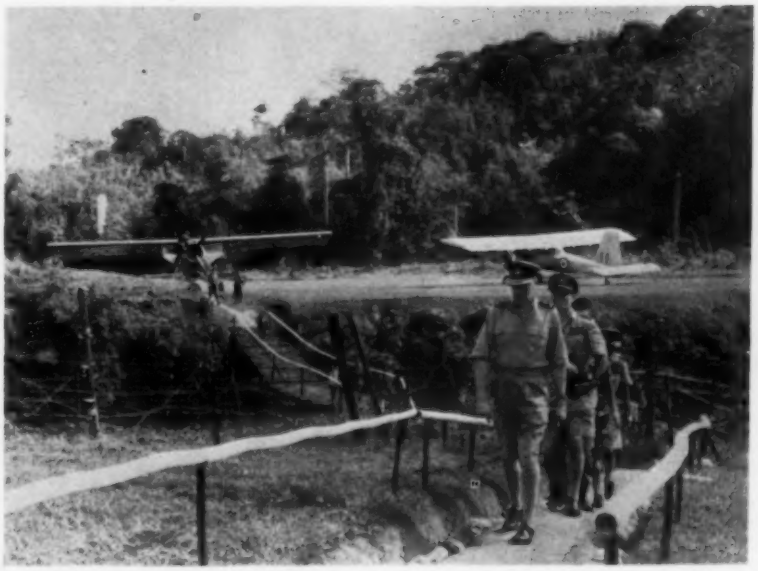


*During his recent visit to Malaya, Air Chief Marshal Sir Dermot Boyle, Chief of the Air Staff, flew in a Prestwick Pioneer of No. 267 Sqn. to visit the airstrip at Fort Shean in the state of Pahang. He is here seen walking with senior F.E.A.F. officers to the headquarters building by the airstrip.*

# SERVICE AVIATION

## *Royal Air Force and Fleet Air Arm News*

### R.Aux.A.F. Anniversary

A BALL will be held at the Savoy Hotel, London, on February 24th to commemorate the 30th anniversary of the formation of the Royal Auxiliary Air Force. The first squadron was formed in 1925, but the anniversary celebrations had to be postponed from last year to the late winter season because of R.Aux.A.F. commitments for summer camps and air exercises.

### C.A.S. Returns

AFTER his 20,000-mile tour of R.A.F. establishments in the Mediterranean and the Middle and Far East, Air Chief Marshal Sir Dermot Boyle, Chief of the Air Staff, landed his Canberra B.6 at London Airport, five minutes ahead of schedule, on February 8th. He had taken off from Malta 2 hr 55 min earlier.

During most of his tour Sir Dermot piloted the aircraft. By using this means of travel he had saved several working days and had had to spend less than 48 hours in the air. The new C.A.S. has considerable experience of jet flying; even before this tour he had made several notable long-distance flights in Canberras.

### U.L.A.S. Coming-of-age

THE University of London Air Squadron celebrated its 21st anniversary at a dinner held at Imperial College, Kensington, London, on February 3rd. The squadron now flies its Chipmunks and Harvards from Kenley and boasts a flourishing Fighter Control Unit whose personnel includes several women undergraduates.

W/C. I. J. Spencer, the Commanding Officer, proposing the health of the guests, paid tribute to what he termed last year's most successful pupil pilot, Lord de L'Isle and Dudley, who, at 46 years of age, went solo in ten hours. The C.O. went on to greet A.V-M. F. H. M. Maynard, the squadron's first C.O., and presented a large crested wooden key symbolizing the squadron's newly acquired maturity. The response was made by Mr. J. F. Lockwood, the Vice-Chancellor.

The toast of the squadron was proposed by Mr. Christopher Soames, making his first appearance at this type of function since his appointment as Under-Secretary of State for Air. He referred to the squadron's steady growth and its achievement both in war and peace. Stressing the growing need for high intelligence, skill and ability in the Service, he said that whereas many years ago an officer needed no vivid imagination in order to attain high rank, he now needed both knowledge and imagination.

Mr. Soames noted with approval that the squadron had been the first of the university units to allow women to join its F.C.U. Without giving any details, he also remarked that coming increases in Service pay would make the R.A.F. more attractive as a career than politics.

In a reply on behalf of the squadron, Mr. L. Borley, of Birkbeck, expressed the hope that the squadron would not still be equipped with Chipmunks at the time of its jubilee. In many ways, he said, the members regretted the move from Booker, but no longer would they be tempted to lap Stirling Moss at Silverstone with a Chipmunk. In face of the varied flying restrictions consequent upon Kenley's position in the London Control Zone, he looked to Merrydown, "that great leveller", to have a desirable effect. Finally, he remarked a little sadly that, while flying members dealt with piston-engined Chipmunks, the mostly chairborne members of the F.C.U. were dealing with jets.

Finally, W/C. Spencer presented three new trophies for the first time. The recipients are portrayed in an illustration on the next page.

### Antarctic Austers

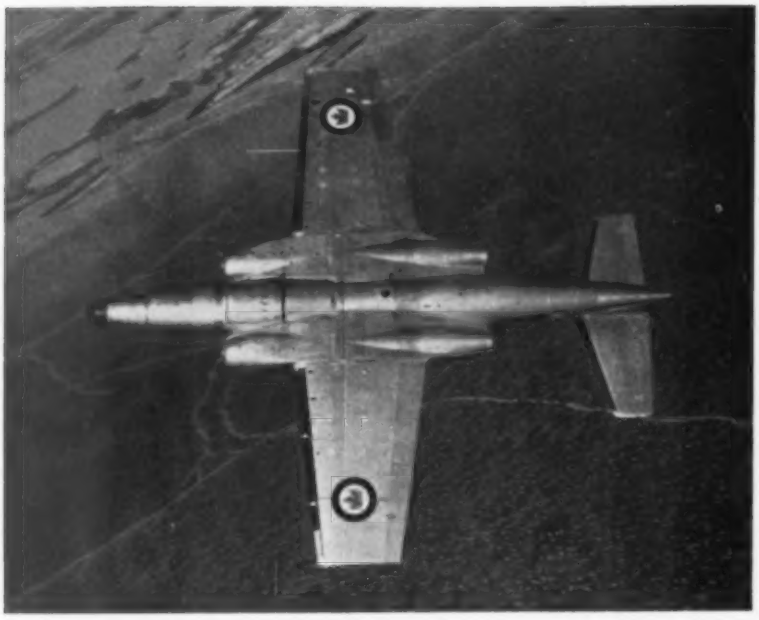
IN a message from the Antarctic, Dr. Vivian Fuchs, leader of the Trans-Antarctic Expedition, has paid tribute to the work of the R.A.F. element in helping the expedition ship *Theron* in its task of establishing a base camp. The R.A.F. team is led by S/L. J. H. Lewis, who reported that, in the pack-ice, bad luck confined flying to the two occasions when pools of ice-free water were available. The aircraft had, however, behaved exceptionally well and servicing had not so far presented any difficulty. Three holes made in the wings of one Auster—by lumps of ice thrown up after dynamite was used to free the ship from the ice-floes—were patched by F/Sgt. P. B. Weston, the aircraft fitter. All radio equipment had worked efficiently, especially the radio compass. The two aircraft are now mounted on skis.

### Hunter Mishap

ON February 8th, eight Hunters from the Central Fighter Establishment at West Raynham were caught short of fuel by a sudden deterioration in the weather. Visibility is reported to have been 660 yd, with seven-eighths cloud cover at 100ft. The aircraft were diverted to Marham, but out of the eight only two made successful landings. Four pilots baled out and landed safely in the Swaffham area and another crash-landed just short of the runway at Marham and was unhurt; but S/L. R. A. Tumilty was killed making a crash-landing some distance further out from the runway.

An unexpected cold front arrived, and —it is reported—the weather clamped 20 minutes after the formation took off; a recall signal had been sent.

*One of the McDonnel F2H-4 Banshees now being delivered to the Royal Canadian Navy.*



*Well past the vertical, this CF-100 Mk 4 of the R.C.A.F.'s Central Flying School, Trenton, was photographed by L.A/C. B. Herron from an aircraft flown by F/L. Titmuss, who is on exchange posting from the R.A.F. The pilot of the CF-100 was F/L. Russell Scott.*

## SERVICE AVIATION . . .

### R.A.A.F. Convairs

IT is reported from Australia that the first of the two Convair 440 transports for No. 6 Transport Wing of the R.A.A.F. will be flown to Australia by an Australian ferry crew this month.

### Norwegian Mountain Rescue Course

FIVE members of R.A.F. mountain rescue teams, led by S/L. A. R. Gordon-Cumming, Air Ministry Inspector of Mountain Rescue, have taken part in a mountain rescue course organized by the Norwegian Red Cross at Gardermoen. The R.A.F. group consisted of F/O. J. A. H. Anderson, Leuchars; Sgt. J. McMichael, Valley; Sgt. A. E. Theakston, Topcliffe; and L.A/C. P. Mason, Kinloss.

### The Chadwick Gold Medal

THE Chadwick Gold Medal for outstanding medical research work has been presented by the London School of Hygiene and Tropical Medicine to G/C. C. Crowley, S.M.O., Air H.Q. Levant. The presentation was made on January 29th by Air Marshal Sir Claude Pelly, A.O.C-in-C. M.E.A.F. G/C. Crowley carried out research into health safeguards for Air Ministry staff handling industrial compounds and substances.

### Royal Air Force Appointments

THE following are among recent Royal Air Force appointments announced by the Air Ministry:—

G/C. H. B. Collins, to H.Q., Fighter Command, for technical staff duties; G/C. J. N. Jefferson, C.B.E., to Supreme Headquarters Allied Powers Europe, for staff duties; G/C. A. A. Case, O.B.E., to R.A.F. Nicosia, to command (instead of G/C. Pleasance, as recently announced); G/C. H. P. Pleasance, O.B.E., D.F.C., to R.A.F. Chivenor, to command; G/C. E. J. Smith, to R.A.F. Wickenby, to command; G/C. J. Whitehead, to Air H.Q., Malta, for administrative staff duties; G/C. C. F. C. Wright, D.S.O., D.F.C., to Allied Forces Southern Europe, for staff duties; G/C. G. M. Gillan, to R.A.F. St. Merryn, to command; G/C. D. G. O'Shea, to H.Q., Maintenance Command, for administrative staff duties; G/C. F. J. M. Pryer, to H.Q., No. 24 Group, for administrative staff duties.

W/C. J. D. S. Huxley, to British Joint Services Mission (U.S.A.), for staff duties (with acting rank of group captain); W/C. A. L. Arrow, to H.Q., No. 41 Group, for technical staff duties; W/C. J. A. Bush, D.F.C., to R.A.F. Bassingbourn, for administrative duties; W/C. J. R. Davenport, to R.A.F. Odiham, for administrative duties; W/C. J. L. Davey, to H.Q., No. 40 Group, for technical staff duties; W/C. G. Kennedy, A.F.C., D.F.M., to H.Q., Bomber Command, for administrative staff duties; W/C. B. E. Peck, D.F.C., to R.A.F. St. Athan, to command No. 19 M.U.; W/C. L. G. Schwab, D.F.C., to R.A.F. North Luffenham, for administrative duties; W/C. P. F. Weller, to H.Q., No. 41 Group, for technical staff duties; W/C. V. M. Montanini, to No. 5 Signals Wing, to command; W/C. S. J. Peters, to R.A.F. Church Fenton, for technical duties; W/C. H. Sullivan, to No. 38 (L.A.A.) Wing, to command.

W/C. E. R. Bell, M.V.O., D.F.C., A.F.C., to R.A.F. Hemswell, for flying duties; W/C. A. B. Bishop, to R.A.F. Lichfield, to command; W/C. A. Hindley, A.F.C., to Air Ministry, for duty in the department of the Chief of the Air Staff; W/C. B. B. Hurley, to R.A.F. Akrotiri, for technical duties; W/C. L. B. B. King, to Air Ministry, for duty in the department of the Air Member for Supply and Organization; W/C. C. N. McLoughlin, to Air Ministry, for duty in the department of the Air Member for Personnel; W/C. F. Parvin, to H.Q., No. 41 Group, for technical staff duties; W/C. J. S. Rowlands, G.C., O.B.E., to R.A.F. Binbrook, for technical duties; W/C. C. V. G. Usher, to R.A.F. Staff College, Bracknell, for Directing Staff duties; W/C. R. B. Ward, to R.A.F. Hullavington, for administrative duties.

S/L. D. C. H. Simmons, A.F.C., to R.A.F. Stradishall, for flying duties (with acting rank of wing commander); S/L. A. E. G. Pye, to R.A.F. Chigwell, to command (with acting rank of wing commander).

### Hat Trick

AN officer who has just relinquished command of No. 98 Squadron at R.A.F. Station Jever, Germany, to attend the next course at the R.A.F. Staff College, has the distinction of having served three tours with the squadron. He is S/L. J. H. Smith-Carrington, and his first tour was in 1942-1944, when the squadron flew Mitchell light bombers, mainly against tactical targets in Germany and occupied Europe. The second was in 1945-1946, when the unit had Mosquitoes and was latterly based in Germany. His third tour, as commanding officer was from August 1953 until December 1955, during which the squadron became the first Hunter unit of the 2nd Tactical Air Force. The new squadron commander is S/L. D. T. Adamson, formerly A.D.C. to the Commander-in-Chief, 2nd Tactical Air Force.

*At the University of London Air Squadron's recent coming-of-age dinner Mr. Christopher Soames (left), Under-Secretary of State for Air, and W/C. I. J. Spencer (right), the C.O., congratulated the winners of the new Squadron trophies. They were (left to right, centre) P/O. P. J. Phillips, Bennett Trophy, P/O. M. A. Collier, a fighter controller, Field Cup, and P/O. J. E. Watts-Phillips, Spencer Cup.*

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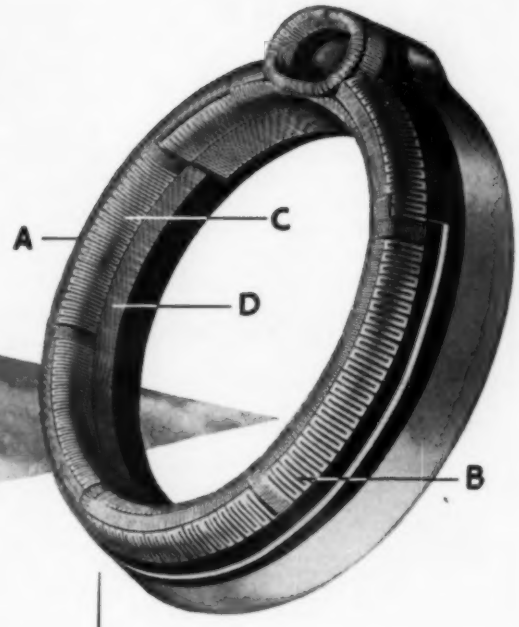


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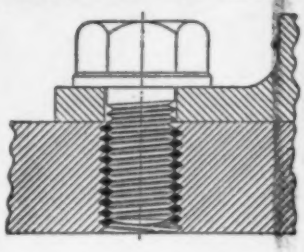

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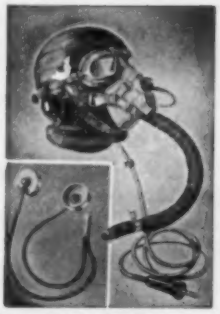

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Applications are invited to fill design and technical staff vacancies in the Airframe Department at Luton and Stevenage.

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**PROJECT DESIGNER** to join in the formulation of initial design proposals for Guided Weapons Projects.

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Housing assistance can be given in most cases.

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## PUBLIC APPOINTMENTS

SENIOR Scientific Officer (min. age 26) req'd. by Aeroplane and Armament Experimental Estab., Min. of Supply, near Amesbury, Wilts., for Research Section of Performance Division. This Section evolves such flight tests and analysis methods as will enable Division to meet future commitments of flight testing. Candidates should have a 1st or 2nd class Hons. Degree in Maths., Physics or Engineering, or equiv. At least 3 years post graduate research experience required and keen interest in new developments in this field essential. Salary within range, £1,030-£1,185 (Superannuable). Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting A43/6A/EY. Closing date 15 March, 1956. [4852

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Keen young men with experience of aircraft design or engineering are required to work on a number of interesting projects where they can apply their ideas and experience to problems in:—

- Design and Weight Analysis of Optimum Structures
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- Modern forms of propulsion
- Aerodynamics of High Speed Aircraft
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- Use of guided weapons and radar equipments
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For these vacancies, Designers should have H.N.C. or better and a minimum of five years' experience in aircraft design. Engineers should have a degree or equivalent, and experience in one or more of the above subjects.

The Company's experience in designing and building modern aircraft ensures that the work undertaken in the Project Section will be of a sufficiently advanced nature to interest young Designers and Engineers of the right calibre.

The Aircraft Division is situated near a pleasant residential part of the Lancashire coast and assistance in removal expenses will be given in certain cases. Interviews can be arranged in London if desired. Apply, giving full details of education and experience, to:—

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The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

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Invite applications for the following vacancies in the Assessment Group.

(1) **A MECHANICAL OR AERONAUTICAL ENGINEER** with an interest in vibration problems and aero-plastic studies.
Qualifications should include a degree, and previous experience in this type of work is desirable but not essential.

(2) **TECHNICIANS.** 5 Technicians are required for analysis and interpretation of flight test results. The essential qualifications would be an Honours degree in Mathematics or Physics, and while previous experience is desirable it is not essential.

(3) **MATHEMATICIANS OR MATHEMATICAL PHYSICISTS.** 2 Mathematicians or Mathematical Physicists are required for interesting work in the Assessment and Aerodynamic Sections.
Applicants should possess a 1st or 2nd class Honours degree and, while previous experience is not essential it would be an advantage.

(4) **TECHNICAL ASSISTANTS.** A number of Technical Assistants are required for interesting work in the Analysis Section.
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All these posts offer an interesting and permanent career, together with attractive salaries and opportunities for advancement.
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SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.,
BAGINTON, Nr. COVENTRY.
**Quoting reference A/4/ARM/TAO.**

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with experience in computation and analysis of test records, is required by

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for work on the analysis of motor trials.

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It is proposed to make an appointment in the age group 30/35 yea. s, from candidates possessing good technical background in Aviation, preferably with a knowledge of Aero Gas Turbine Engines, and some flying experience. Personality is of prime importance, as the work will entail mixing with Executive of the Aircraft Industry, and Air Lines of all nationalities. The duties will involve overseas travel with absence from home for anything up to six months in a year, in broken periods. The salary would be commensurate with experience, age and qualifications.

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## PUBLIC APPOINTMENTS

**FEDERATION OF RHODESIA AND NYASALAND**

**VACANCY: INSPECTOR OF AIRCRAFT: DEPARTMENT OF CIVIL AVIATION**

APPLICANTS, preferably under 35, but not over 45, should hold Cats. A, B. and C (or A, C. & D) of an aircraft maintenance engineers licence. (Applicants licensed in A & C. only considered if experience specially relevant). A minimum of 5 years post-training experience of maintenance, overhaul and repair of airframes and aero engines required.

COMMENCING salary £1,400 on scale rising to £1,550.

APPLICATION forms and further details from Secretary, Rhodesia House, 429 Strand, London, W.C.2.

CLOSING date February 25. [4789

## PUBLIC ANNOUNCEMENTS

**AIR TRANSPORT ADVISORY COUNCIL**

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled services:—

APPLICATION No. 719. From Starways Ltd., of Liverpool Airport, Liverpool 19, for a Seasonal Inclusive Tour Service with Dakota aircraft in conjunction with Cathedral Touring Agency for the carriage of passengers between Glasgow (Renfrew) and Tarbes (for Lourdes) at a frequency of from one to three return flights weekly during the season from June to October inclusive each year for a period of three years, commencing 1st June, 1956.

APPLICATION No. 312/4. From Aquila Airways Ltd. of 1, Great Cumberland Place, London, W.1., for an amendment to the terms of approval of the Normal Scheduled Sevice which the Company are approved to operate with Solent and Hythe flying boats for the period up to 31st May, 1962 between Southampton Water and Genoa and/or Santa Margherita at a frequency of four return flights per week in summer and three in winter, two of which flights are to be operated by way of a traffic stop at Marseilles, so as to operate instead during the summer season from 1st May to 15th October at a maximum frequency of eight return flights per week, two of which at the discretion of the Company could be operated by way of a traffic stop at Marseilles.

FROM B.K.S. Air Transport Ltd., of 1, Marylebone High Street, London, W.1.:—

APPLICATION No. 720 for a Seasonal Inclusive Tour Service with Dakota and Viking aircraft in conjunction with Sky Tourist Services Ltd., for the carriage of passengers and supplementary freight between Southend and Basle at a frequency of one service weekly on Fridays during the season from April to October inclusive each year for a period of seven years, commencing 1st May, 1956.

APPLICATION No. 216/3, for amendments to the terms of approval of the U.K. Internal Service which the Company are approved to operate with Dakota and Avro Anson aircraft on the route Newcastle (Woolsington) and/or West Hartlepool (Greatham) and/or Leeds (Yeadon)-Bournemouth (Hurn) (optional)-Isle of Wight (Bembridge) at a frequency of up to seven return flights weekly for the period up to 31st March, 1961, so as to permit the operation of Consul aircraft also and an increase of the maximum frequency up to 30 return flights weekly on all sectors together with permission to operate terminating flights on the Bournemouth-Isle of Wight sector.

APPLICATION No. 409/2. From Silver City Airways Ltd. of 1, Great Cumberland Place, London, W.1., for an amendment to the terms of approval of the Vehicle Ferry Service which the Company are approved to operate with Bristol 170 aircraft between Belfast (Newtownards) and Stranraer (Castle Kennedy) at a frequency of up to 12 return flights daily for the period up to 31st December, 1961, so as to increase the frequency up to 20 return flights daily.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1., from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4849

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## PATENTS

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THE Director General, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

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| Aircraft Nut Lock Nuts etc. | 19010/GNS/VP.1 |
| Aircraft Wing Nuts Washers etc. | 19013/GNS/VP.1 |
| Aircraft Rivets etc. | 19016/GNS/VP.1 |

DETAILS of requirements and terms are obtainable with tender forms, which are returnable by Tuesday, 13th March, 1956 and may be obtained at the above mentioned address (Room 302D) on payment of 10 shillings each. Tender fee is not returnable. REFERENCE number of each of the above mentioned tenders should be quoted in all correspondence. [4829

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**SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.**

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1. **Deputy to Chief Dynamics Engineer.**
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Applicants must have completed an apprenticeship with a well known firm and should have a minimum of five years experience on Research or Development work; preferably with some experience of vibration or climatic testing.
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The salary scale will be commensurate with the high degree of responsibility associated with this post.
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Two Technicians are required for Dynamic and Climatic investigations which cover a wide variety of problems.
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These posts offer an interesting career, together with attractive salaries and with good opportunities for advancement.
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All replies should be addressed to:—

**Technical Appointments Officer,**
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**Baginton, Nr. Coventry.**

Quoting reference ARM/TOA. [4760

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Requires a B.Eng. degree, or H.N.C., plus a minimum of 3 years experience in aircraft stress analysis.

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Requires a B.Eng. degree, or H.N.C., plus a minimum of 3 years experience, to plan and carry out vibration and dynamic testing and analysis of results, for flutter, vibration and aero-elastic problems.

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Requires a B.Sc. in maths. or maths and physics and experience in automatic computing work, for programming, solution and some development work on digital and analog computors.

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"X" endorsement for Electrical equipment and Ignition Systems. To be based at Khartoum. Salary £E.670-£E.850, according to experience. Location allowance £E.745 (married), £E.550 (single). Five year appointment.

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Please quote reference: WT3.ARM/TAO. [4826

JIG AND TOOL DESIGNERS, AND PLANNING ENGINEERS. A LARGE MIDLAND FIRM HAVE VACANCIES FOR HIGHLY SKILLED MEN. ONLY THOSE WITH AERO ENGINE PRODUCTION EXPERIENCE NEED APPLY TO BOX AC16419 SAMSON CLARK 57-61, MORTIMER ST W.1. [4854

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LIFE Assurance/Superannuation Schemes.

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ENGINEER, not necessarily licensed, required primarily for maintenance of flying school fleet. Previous light aircraft experience essential, and must be able to work on own initiative. Light Plane Maintenance Services, Elstree Aerodrome, Elstree, Herts. Telephone Elstree 3586. [4815

# technicians

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DEVELOPMENT Engineer for work on development of fuel systems and components. Knowledge of servo mechanisms and hydraulics an advantage. Qualification H.N.C. or equivalent.

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EXCELLENT working conditions. Pension Scheme. House purchase assistance considered. Within easy reach of Bournemouth. Special transport facilities. Apply in writing to Personnel Manager, Flight Refuelling Limited, Tarrant Rushton Airfield, Nr. Blandford, Dorset. [4809

CAPTAIN required for Dakota and Marathon aircraft. Minimum requirements Senior Commercial and Instrument Rating. Apply in writing to Chief P.lot, Derby Aviation Ltd., Burnaston Airport, Derby. [4835

GERMAN Charter Company requires one Viking captain. Routes mainly European. Salary including overseas allowance £225 per month. Apply Personnel Officer, Lufttransport Union G.M.B.H., Slughasen, Rhein Main, Frankfurt. [4840

STRESSMEN required for interesting work in new expanding department of well established firm. pleasant office situated near the South Devon coast. Apply stating age, experience and salary required to:—Design Office Superintendent, West Airways, Ltd., Exeter Airport. [4767

METALLURGIST or metallurgical engineer required with experience in metals for jet engines and aircraft as liaison between semi-manufacturer producers works, sales and customers. Good salary, pension scheme. Age about 30 years. Write Box ZQ 740, Deacon's Advtg. 36 Leadenhall St. E.C.3. [4831

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FULL particulars in writing to the Chief Engineer, The Fairey Aviation Co., Ltd., Hayes, Middlesex. [4804

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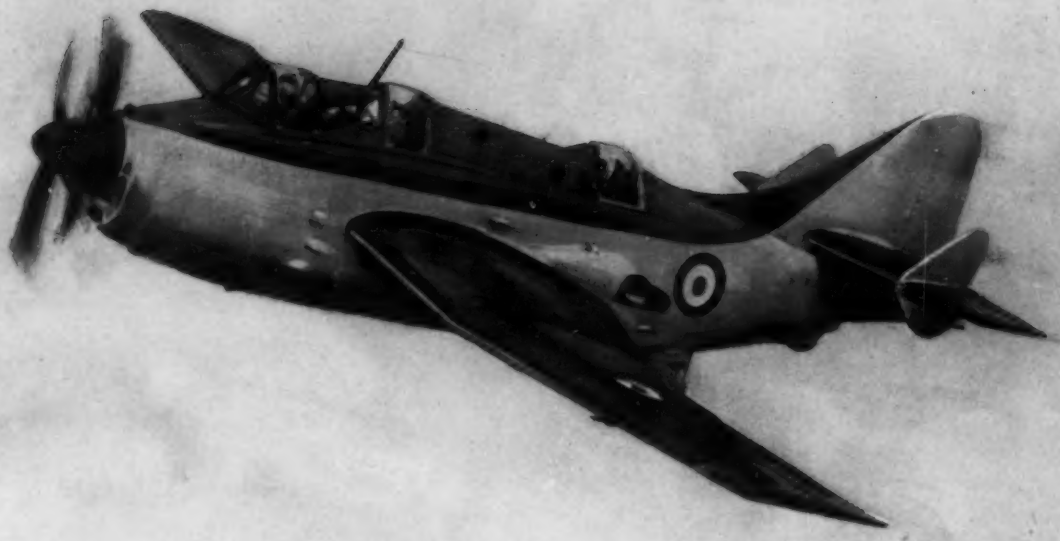

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